305-CD-032-001

**EOSDIS Core System Project**

# Release B MSFC DAAC Design Specification for the ECS Project

Preliminary

October 1995

Hughes Information Technology Corporation
Upper Marlboro, Maryland

# Release B MSFC DAAC Implementation/Design Specification for the ECS Project

**Preliminary**

**October 1995**

Prepared Under Contract NAS5-60000
CDRL Item 046

**APPROVED BY**

| | |
|---|---|
| Craig Schillhahn /s/ | 10/10/95 |
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# Preface

This document is one of twenty comprising the detailed design specifications of the SDPS and CSMS subsystem for Release B of the ECS project. A complete list of the design specification documents is given below. Of particular interest are documents number 305-CD-020, which provides an overview of the subsystems and 305-CD-039, the Data Dictionary, for those reviewing the object models in detail. A Release B SDPS and CSMS IDR Review Guide (510-TP-003-001) is also available.

The SDPS and CSMS subsystem design specification documents for Release B of the ECS Project include:

| | |
|---|---|
| 305-CD-020-001 | Release B Overview of the SDPS and CSMS Segment System Design Specification |
| 305-CD-021-001 | Release B SDPS Client Subsystem Design Specification |
| 305-CD-022-001 | Release B SDPS Interoperability Subsystem Design Specification |
| 305-CD-023-001 | Release B SDPS Data Management Subsystem Design Specification |
| 305-CD-024-001 | Release B SDPS Data Server Subsystem Design Specification |
| 305-CD-025-001 | Release B SDPS Ingest Subsystem Design Specification |
| 305-CD-026-001 | Release B SDPS Planning Subsystem Design Specification |
| 305-CD-027-001 | Release B SDPS Data Processing Subsystem Design Specification |
| 305-CD-028-001 | Release B CSMS Segment Communications Subsystem Design Specification |
| 305-CD-029-001 | Release B CSMS Segment Systems Management Subsystem Design Specification |
| 305-CD-030-001 | Release B GSFC Distributed Active Archive Center Design Specification |
| 305-CD-031-001 | Release B LaRC Distributed Active Archive Center Design Specification |
| 305-CD-032-001 | Release B MSFC Distributed Active Archive Center Design Specification |
| 305-CD-033-001 | Release B EROS Data Center Distributed Active Archive Center Design Specification |
| 305-CD-034-001 | Release B ASF Distributed Active Archive Center Design Specification |
| 305-CD-035-001 | Release B NSIDC Distributed Active Archive Center Design Specification |
| 305-CD-036-001 | Release B JPL Distributed Active Archive Center Design Specification |
| 305-CD-037-001 | Release B ORNL Distributed Active Archive Center Design Specification |

305-CD-038-001 Release B System Monitoring and Coordination Center Design Specification

305-CD-039-001 Release B Data Dictionary for Subsystem Design Specification

This document is a formal contract deliverable with an approval code of 3; as such it is delivered to NASA for information only, but is subject to approval as meeting contractual requirements. This document is under the configuration control of the ECS Release B Configuration Control Board. Changes to this document shall be made by document change notice (DCN) or by complete revision.

Any questions should be addressed to:

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# Abstract

The Release-B Marshall Space Flight Center (MSFC) Distributed Active Archive Center (DAAC) Design Specification describes the ECS subsystems at the MSFC DAAC. ECS Subsystem-Specific Design Specifications provide detailed design descriptions of the subsystems. This document shows the specific implementation of that design at the MSFC DAAC, including the identification of the specific software, hardware and network configuration for the DAAC.

***Keywords:*** MSFC, DAAC, configuration, design

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# 1. Introduction

## 1.1 Identification

This Release B MSFC DAAC Design Specification for the ECS Project, Contract Data Requirement List (CDRL) Item 046, with requirements specified in Data Item Description (DID) 305/DV3, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract NAS5-60000.

## 1.2 Scope

Release B of ECS supports functional capabilities and services required to meet driving requirements and milestones such as:

- Functionality/services required to support mission operations for the continuation of TRMM as well as the initiation of LANDSAT-7, COLOR, ADEOS II and EOS AM-1. This includes planning and scheduling, command and control, production data processing, data distribution and other ECS functions
- Functionality/services required to support mission operations for the initiation of SAGE III Flight-Of-Opportunity (FOO) and ACRIM FOO. This includes production data processing, data distribution and other ECS functions.
- Provide information management, data distribution and a high level archive for the SAR data from the ERS-1/2, JERS-1 and RADARSAT spacecraft.
- Functionality/services required to support EOS ground system interface testing which includes end-to-end mission simulations, communication services for EBnet, network management services and other ECS services.
- Functionality/services required for V0 Interoperability and V0 Leapfrog.
- Functionality/services required for Science Software I&T Support for TRMM, LANDSAT 7, COLOR, ADEOS II, EOS AM-1, SAGE III Flight-Of-Opportunity (FOO), ACRIM FOO, Space Station, and EOS PM-1.

Several of the driving requirements and milestones were initially supported by Release A but are expanded upon for Release B. For example, infrastructure Data Flow and End-to-End Testing and Simulation Readiness Testing were supported early-on by Release A, and will be fully supported by Release B during the final phases of testing. Likewise, V0 interoperability is supported by Release A for GSFC, MSFC, LaRC and EDC DAACs and is expanded to the remaining DAACs in Release B.

ECS will provide support to nine Distributed Active Archive Centers (DAACs). The DAACs are tasked with generating EOS standard data products and carrying out NASA's responsibilities for data archive, distribution and information management. The DAACs serve as the primary user interface to EOSDIS. These DAACs are located at: Goddard Space Flight Center (GSFC)

Greenbelt, MD; Langley Research Center (LaRC) Hampton, VA; Oak Ridge National Laboratory (ORNL) Oak Ridge, TN; Marshall Space Flight Center (MSFC) Huntsville, AL; EROS Data Center (EDC) Sioux Falls, SD; National Snow and Ice Data Center (NSIDC) Boulder, CO; Jet Propulsion Laboratory (JPL) Pasadena, CA; the Alaska SAR Facility (ASF) at the University of Alaska Fairbanks; and the Consortium for International Earth Science Information Network (CIESIN).

This document is part of a series of documents comprising the Science and Communications Development Office design specification for the Communications and System Management segment (CSMS) and the Science and Data Processing Subsystem (SDPS) for Release B. The series of documents include an overview, a design specification document for each subsystem, and a design implementation document for each DAAC involved in the release, as well as one for the System Monitoring and Control (SMC) center.

This document specifically focuses on the MSFC DAAC ECS configuration and capabilities at Release B. It is released, and reviewed at the formal Release B Incremental Design Review (IDR).

This document reflects the August 23, 1995 Technical Baseline maintained by the contractor configuration control board in accordance with ECS Technical Direction No. 11, dated December 6, 1994.

## 1.3 Purpose

The purpose of this document is to show the elements of the Release B ECS science data processing and communications design that will support the MSFC ECS DAAC in meeting it's objectives. The Release B Overview of SDPS and CSMS (305-CD-020-001) provides an overview of the ECS subsystems and should be used by the reader in order to get a basic understanding of ECS design components. The Release Plan Content Description document (222-TP-003-008) provides a detailed mapping of functional capabilities and services that will be available for each release. While some DAAC configurations vary depending on the mission/capability requirements for ECS at their DAAC, the MSFC DAAC at full ECS capability will include all of the ECS science data processing and communications subsystems.

## 1.4 Status and Schedule

This submittal of DID 305/DV2 meets the milestone specified in the Contract Data Requirements List (CDRL) for Incremental Design Review (pre-IDR) of NASA Contract NAS5-60000. The submittal will be reviewed during the Release B (IDR) and changes to the design which resulted from that review will be reflected in subsequent updates. Further updates are planned for the Release B CDR.

## 1.5 Document Organization

This document is organized to describe the design of ECS at the MSFC DAAC as follows:

Section 1 provides information regarding the identification, scope, status and schedule, and organization of this document.

Section 2 provides a listing of the related documents which were used as source information for this document.

Section 3 provides a description of the ECS design at the MSFC DAAC. It includes a description of the DAAC external interfaces, ECS software implementation, including identification of Off the Shelf (OTS) products, hardware configuration and operational activities.

- Subsection 3.1 establishes the context for the technical discussions with an overview of the specific MSFC ECS DAAC mission and MSFC Release B operations. It identifies the key ECS related mission and operations activities that are supported via the ECS functionality at the DAAC.
- Subsection 3.2 addresses the external interfaces of the ECS subsystems as implemented at MSFC ECS DAAC. Major interfaces include TSDIS, the Version 0 System IMS, Version 0 DAACs, and the LIS Scientific Computing Facility (SCF).
- Subsection 3.3 provides a software component analysis. There are 10 ECS data processing and communications subsystems that contain Hardware Configuration Items (HWCIs) and Computer Software Configuration Items (CSCIs). This section addresses the CSCIs and their corresponding lower level Computer Software Components (CSCs). The CSCs are described in detail in their respective subsystem design specification documents. In this section, the CSCs are captured in a single table, broken down by Subsystem/CSCI. The table lists the CSCIs and the associated CSCs. Notes are provided to expand upon generic explanations from the body of the Subsystem Design Specifications to describe what makes the particular CSC specific to the DAAC. In addition, when a CSC is identified as Off-the-shelf (OTS), the candidate product is identified.
- Subsection 3.4 provides a DAAC specific discussion of the ECS data processing and communications Hardware Configuration Items (HWCIs). This section identifies the HWCI components and indicates the specific components and quantities that are resident at the DAAC. It includes the Local area network (LAN) configuration and the rationale for the specific hardware configuration.
- Subsection 3.5 provides a software to hardware configuration mapping.

Section 4 gives a description of what can be expected in the next release of ECS.

The final section, Abbreviations and Acronyms, contains an alphabetized list of the definitions for abbreviations and acronyms used in this document.

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# 2. Related Documentation

## 2.1 Parent Documents

The parent documents are the documents from which the scope and content of this Release B MSFC DAAC Design Specification are derived.

| | |
|---|---|
| 194-207-SE1-001 | System Design Specification for the ECS Project |
| 220-CD-001-004 | Communications Requirements for the ECS Project |
| 305-CD-020-001 | Release B SDPS/CSMS Design Specification Overview for the ECS Project |
| 305-CD-021-001 | Release B SDPS Client Subsystem Design Specification for the ECS Project |
| 305-CD-022-001 | Release B SDPS Interoperability Subsystem Design Specification for the ECS Project |
| 305-CD-023-001 | Release B SDPS Data Management Subsystem Design Specification for the ECS Project |
| 305-CD-024-001 | Release B SDPS Data Server Subsystem Design Specification for the ECS Project |
| 305-CD-025-001 | Release B SDPS Ingest Subsystem Design Specification for the ECS Project |
| 305-CD-026-001 | Release B SDPS Planning Subsystem Design Specification for the ECS Project |
| 305-CD-027-001 | Release B SDPS Data Processing Subsystem Design for the ECS Project |
| 305-CD-028-001 | Release B CSMS Communications Subsystem Design Specification for the ECS Project |
| 305-CD-029-001 | Release B CSMS Systems Management Subsystem Design Specification for the ECS Project |
| 305-CD-039-001 | Release B Data Dictionary for the ECS Project Subsystem Design Specification |
| 307-CD-004-001 | Release B SDPS Development and Release Plans for the ECS Project |
| 307-CD-005-001 | Release B CSMS Development and Release Plans for the ECS Project |

| | |
|---|---|
| 311-CD-002-003 | Science Data Processing Segment (SDPS) Database Design and Database Schema Specifications for the ECS Project |
| 311-CD-003-003 | Communications and System Management Segment (CSMS) Database Design and Database Schema Specifications for the ECS Project |
| 311-CD-008-001 | Release B SDPS/CSMS Database Design and Database Schema Specifications for the ECS Project |
| 313-CD-006-001 | Release B SDPS/CSMS Internal Interface Control Document for the ECS Project |
| 319-CD-006-001 | Release B System and Segment Integration and Test Plan for the ECS Project |
| 329-CD-004-001 | Release B SDPS Development and Release Plans for the ECS Project |
| 329-CD-005-001 | Release B CSMS Development and Release Plans for the ECS Project |
| 402-CD-003-001 | Release B System and Segment Integration and Test Plan for the ECS Project |

## 2.2 Applicable Documents

The following documents are referenced within this Specification, or are directly applicable, or contain policies or other directive matters that are binding upon the content of this document.

| | |
|---|---|
| 206-CD-002-001 | Release B Version 0 Analysis Report for the ECS Project |
| 209-CD-001-001 | Interface Control Document Between EOSDIS Core System (ECS) and the NASA Science Internet for the ECS Project |
| 209-CD-005-003 | Interface Control Document Between EOSDIS Core System (ECS) and Science Computing Facilities (SCF) for the ECS Project |
| 209-CD-007-002 | Interface Control Document Between the EOSDIS Core System (ECS) and TRMM Science Data and Information System (TSDIS) for the ECS Project |
| 209-CD-011-002 | Interface Control Document Between EOSDIS Core System (ECS) and the Version 0 System |
| 304-CD-002-002 | Science Data Processing Segment (SDPS) Requirements Specification for the ECS Project |
| 305-CD-038-001 | Release B System Monitoring and Coordination Center Design Specification for the ECS Project |
| 313-CD-006-001 | Release B SDPS/CSMS Internal Interface Control Document for the ECS Project |
| 403-CD-002-001 | Release B Verification Specification for the ECS Project |

| | |
|---|---|
| 409-CD-002-001 | Release B Overall System Acceptance Test Plan for the ECS Project |
| 513-CD-002-001 | Release B Hazard Analyses for the ECS Project |
| 514-CD-002-001 | Release B Security Sensitive Items List for the ECS Project |
| 515-CD-002-001 | Release B Availability Models/Predictions for the ECS Project |
| 516-CD-002-001 | Release B Reliability Predictions for the ECS Project |
| 518-CD-002-001 | Release B Maintainability Predictions for the ECS Project |
| 604-CD-001-004 | Operations Concept for the ECS Project: Part 1-- ECS Overview |
| 604-CD-002-002 | Operations Concept for the ECS project: Part 2B -- ECS Release B |
| 604-CD-003-001 | Operations Concept for the ECS Project: Part 2A -- ECS Release A |
| 604-CD-004-001 | Operations Concept for the ECS Project: Part 2 -- FOS |
| 615-CD-002-001 | Release B Special Maintenance and Test Equipment for the ECS Project |
| 622-CD-002-001 | Release B Training Plan for the ECS project |
| 627-CD-001-002 | Security Risk Management Plan for the ECS Project |
| 705-CD-005-002 | Release B IDR Presentation Package |
| 160-TP-004-001 | User Pull Analysis Notebook [for the ECS Project] |
| 210-TP-001-004 | Technical Baseline for ECS Project |
| 222-TP-003-008 | Release Plan Content Description for the ECS Project |
| 420-TP-001-005 | Proposed ECS Core Metadata Standard Release 2.0, Technical Paper |
| 505-41-14 | Goddard Space Flight Center, Interface Requirements Document Between EOSDIS Core System (ECS) and Tropical Rainfall Measuring Mission (TRMM) Ground System |
| 560-203.103 | Goddard Space Flight Center, Interface Control Document Between the Sensor Data Processing Facility (SDPS) and the Tropical Rainfall Measuring Mission (TRMM) Consumers |

## 2.3 Information Documents Not Referenced

Many additional ECS documents are available via the EDHS that amplify and clarify the information presented in this document. EDHS can be accessed via the World Wide Web (WWW) at the following Universal Reference Location: http://edhs1.gsfc.nasa.gov.

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# 3. MSFC DAAC Configuration

## 3.1 Introduction

### 3.1.1 MSFC DAAC Overview

The MSFC Distributed Active Archive Center (MSFC DAAC) is one of the nine DAACs that are part of the NASA Earth Observing System Data and Information System (EOSDIS). These DAACs are generally oriented around scientific disciplines. The objective of the MSFC DAAC is to archive science data and provide support services to its users in the discipline areas of global hydrology, atmospheric dynamics, and lightning. In the pre-EOS time frame, the MSFC V0 DAAC was developed, and is still developing, to enhance and improve scientific research and productivity by consolidating access to remote sensed earth science data, as well as by providing services that give added value to the data stored at the DAAC and help people realize the scientific and educational potential of the global climate data stored at the DAAC.

The MSFC V0 DAAC supports over 100 data sets/products some of which are developed from heritage data concerned with climate, land and ocean precipitation. The DAAC also supports the initial Special Sensor Microwave/Imager (SSM/I) and TOVS data used in development efforts for NASA Pathfinder data sets.

In preparation for the TRMM Mission, an early release of ECS (Interim Release 1) will be made available to support early TRMM interface testing. The equipment and software suites will then be augmented with Release A to partially support the TRMM Mission. Release B will further augment the ECS software and hardware at the MSFC DAAC to fully support TRMM. The Release Content Plan (222-TP-003-008) provides a description of the missions and the driving requirements which must be satisfied to support these missions. In the Release B time frame, the MSFC ECS DAAC will continue to support archive and distribution of data products from the PR, TMI, and LIS instruments flown onboard the TRMM observatory as well as continued generation of LIS data products. In order to support EOSDIS ongoing missions and parallel operation of the DAAC Version 0 system ECS Release B will ensure full access to existing datasets and services.

Figures 3.1.1-1 and 3.1.1-2 illustrate the SDPS and CSMS subsystems and their components. The bulk of this document focuses on the selected elements of the ECS design that are used to achieve Release B objectives at the DAAC. Section 2.1 of this document identifies IDR Design Specifications which provide detailed information on each subsystem.

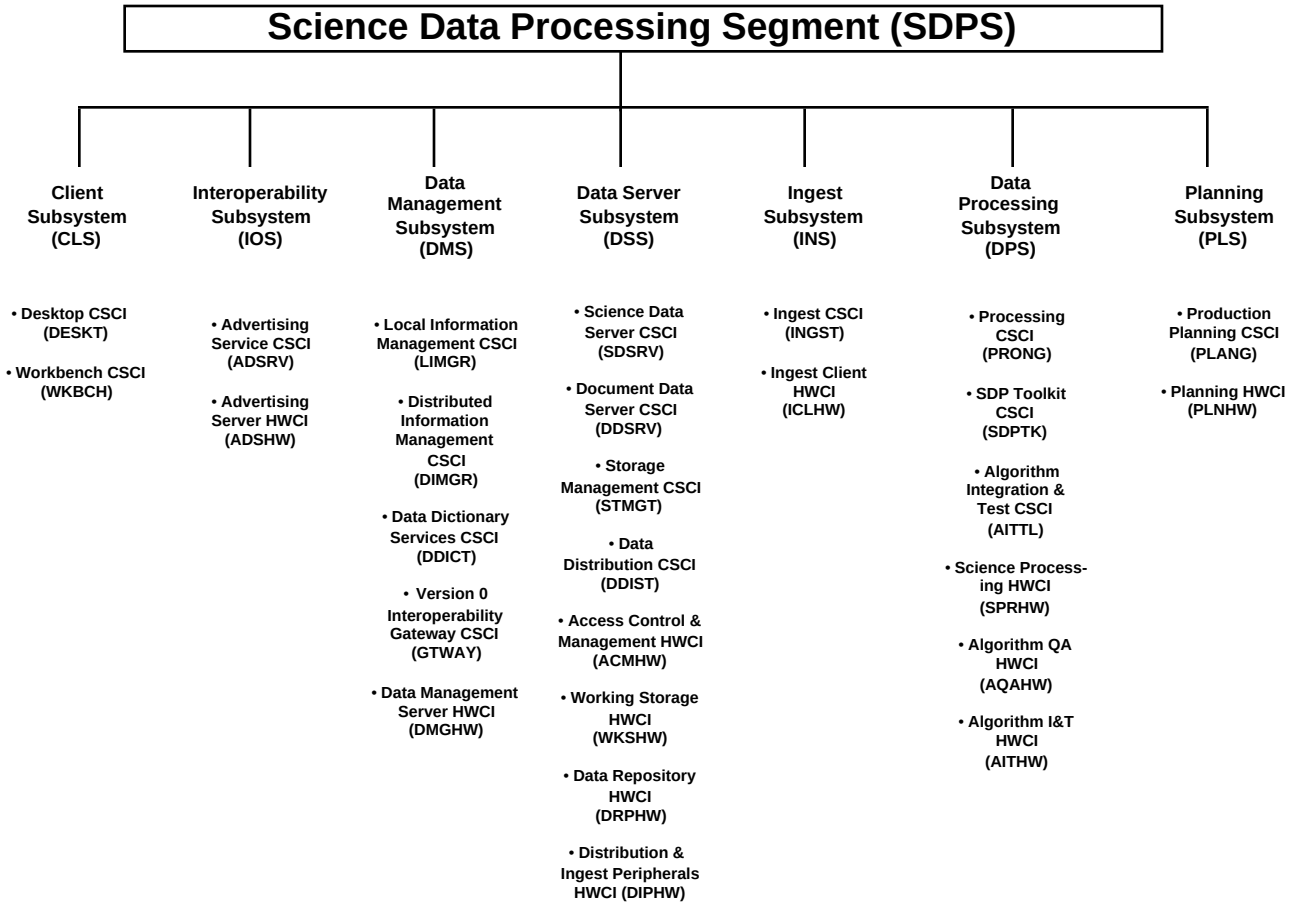


***Figure 3.1.1-1. SDPS Subsystems and Configuration Items***

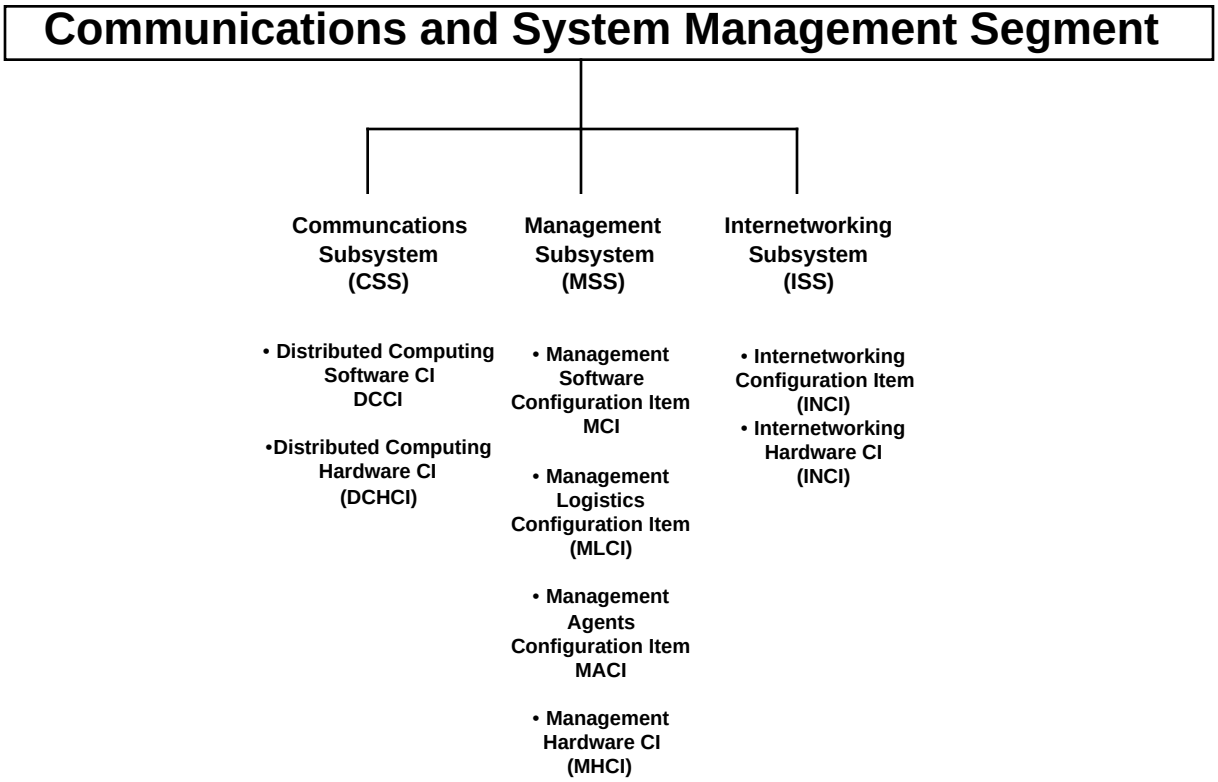


***Figure 3.1.1-2. CSMS Subsystems and Components***

### 3.1.2 DAAC-Specific Mission and Operations Activities

ECS subsystems provide mission and operations functionality for Release B. Key ECS related mission and operations activities supported by the ECS MSFC DAAC include:

- TRMM LIS mission support
- SSM/I data ingest, archive and distribution
- PR/TMI/GV data ingest, archive and distribution
- LIS algorithm updates integration and test
- V0 data migration, archive and distribution
- V0 Interoperability
- V0 Leapfrog
- DAAC Site Activation

**TRMM LIS Mission Support:** ECS provides science software integration and test support, data ingest, processing, archiving, and distribution for these instruments. DAAC-unique components of the MSFC DAAC will be providing some ancillary and correlative data to support the processing and science QA for these missions.

**Independent Verification and Validation (IV&V) Support:** Prior to the Release Readiness Review (RRR), the IV&V contractor can witness and/or monitor release acceptance testing and document nonconformances. Upon successful completion of the RRR, the IV&V contractor verifies that the ECS release operates correctly within the EOS Ground System (EGS). The ECS contractor, specifically the Independent Acceptance Test Organization (IATO), supports the IV&V contractor in this effort for a period of one month following RRR at the operational sites. The IATO coordinates personnel, facilities, and equipment support in the resolution of ECS nonconformances identified during IV&V testing. ECS contractor Maintenance and Operations personnel also support IV&V activities at operational centers, as necessary.

**V0/ADC Interoperability:** Two-way interoperability involves two different capabilities. First, outgoing interoperability allows users to log into the ECS and access ECS services, including the ability to access non-ECS data products from a site external to ECS directly from the ECS user interface. Second, incoming interoperability allows users, who are logged into a non-ECS site, to access ECS data products directly from the non-ECS user interface, using non-ECS IMS services.

Two-way Version 0 interoperability prior to the transition from Version 0 to Version 1 ECS is required to ease the transition process. One-way interoperability with ADCs (ECS to ADCs) is also required early to ease the Version 0 transition. Two-way interoperability with ADCs is not required for Release B.

**Building from Version 0:** Building on Version 0 for a release implies that the release will be capable of matching (in general) the functionality of Version 0 plus adding some features that Version 0 does not have (i.e. "building on to" (or enhancing) existing Version 0 capabilities). This does not mean the release will match every individual function/capability of Version 0. It will be possible (through interoperability) to access some Version 0 functions, without having to make them part of ECS.

The ECS V1 Client will be implemented in Release B, and will completely replace the V0 Client implemented in Release A. In Release B, ECS will deploy an infrastructure that exceeds that in V0, which will provide the foundation from which to add future enhancements which exceed V0.

**Leapfrogging Version 0:** This section presents areas where the ECS provides functionality above and beyond that which will be available to the user community in V0. These capabilities are based on experience with the user community and the Version 0 DAACs as to what improvements on V0 capabilities are important. Examples of this are: search using combinations of logical operators, search on attributes across DAACs & Data Sets, results from search across DAACs & Data Sets, simultaneous display of multiple Browse Data, automated authentication for Data Distribution, Manage Storage System resource

utilization, generating accounting information for Data Distribution, multiple DAAC orders, Science Software Support, and EOS AM-1 Version 2 Algorithm I&T.

The SDPS is the most visible portion of the system to the user (science) community, therefore, most of driving requirements behind capabilities beyond V0 are in this area of the SDPS. Table 3.1.2-1 lists the SDPS capabilities/services that support specific "V0 Leapfrog" driving requirements for the MSFC DAAC.

***Table 3.1.2-1. Driving Requirement/Functional Capability***

| Driving Requirement/Milestone | Segment Functional Capability/Service |
|---|---|
| Information Search | Inventory Search: Cross DAAC coincident search, Complex queries |
| Display of Results | Displaying of a timeline of results |
| Data Set Specific Search Parameters | Search on attributes across DAACs & data sets |
| Data Set Specific Results | Results from searches across DAACs & data sets, |
| Browse | Simultaneous display of multiple browse data, Browse animation |
| Processing Request Services | Multiple DAAC orders |
| Archival Product Requests | Distribution Authentication: Automated authentication for data distribution |
| Order History | Order history across DAACs |
| Toolkit Services | Data Visualization: Data visualization capabilities |
| IMS Toolkit | API for update, query and DBA utilities |
| Communication Services | User Feedback: On-line user survey containing user feedback from all sites |
| Manage Storage System Service | Manage storage system resource utilization, Generate accounting inf. for data distribution |

**Version 0 (V0) Data Migration:** Version 0 (V0) data migration includes the ability to transition V0 data sets from V0 to V1; and provide support, data management, search, and access capabilities for these data sets. High priority data sets were defined to be candidate data sets for V0 transition. Additional data migration takes place during Release B operations.

**DAAC Site Activation:** The EOSDIS DAACs have the mission of processing, archiving and distributing earth science data. MSFC site activation was initially performed for IR-1, with phased activations required for Release A and Release B. These phased activations are characterized by increases in hardware and software functionality,

including added operational responsibilities. This section discusses activities that will take place to facilitate a smooth transition from Release A to Release B.

The ECS contractor will schedule a series of site coordination trips to all DAACs. The objective of these trips is to ensure that the ECS contractor and the DAAC managers are in agreement with all operational issues. When ECS delivers Release B to the sites, ECS will work with the host organizations to ensure that hardware and software installation and segment and system testing all occur in a pre-planned manner that is sensitive to the mission of the host organization. Coordination topics include facility requirements, locations of Release B equipment and personnel, installation and test periods, etc.

Issues of when training and to whom training is provided on Release B products are critical because of the potential impact on operations and user support. Training on COTS hardware and software, and application software, regardless of the development track, is an absolute necessity. If the site's user services are unable to handle issues about a Release B product, additional demands on developers' time will be made to isolate, remedy, or suggest work-arounds to the issues.

The facility access dates must be at least 2 months prior to the scheduled initial Release B installation date to provide time for site verification inspection, completion Government facility preparations, and receiving of COTS HW and SW. Installations of HW and SW take between 2 and 6 weeks depending on whether the site is an initial installation (requiring LAN installation) and the quantity and complexity of the configurations to be installed.

After installation, staffing and training of the maintenance and operations staff is accomplished. M&O training occurs in conjunction with the 3-month system integration and acceptance testing.

ECS subsystems provide mission and operations functionality for Release B. Key ECS related mission and operations activities supported by the ECS portion of the MSFC DAAC include information management, data distribution and a high level data archive.

In addition to automated support, ECS subsystems provide the capability for the ECS operations staff to perform a number of roles in support of these activities. These operational roles for the MSFC DAAC are identified in Table 3.1.2-2. The table identifies the corresponding SDPS or CSMS subsystem that enables the DAAC ECS operations staff to perform a particular role/function. Detailed descriptions of these activities are captured in the ECS Operations Concept for the ECS Project: Part 2B - ECS Release B (604/OP1) document.

***Table 3.1.2-2.* MSFC *Operations Support Functions***

| ECS DAAC Operational Roles | Capability |
|---|---|
| User Services<br>- Support user with data expertise<br>- Generate and maintain data interface | Data Management Subsystem |
| Data Ingest<br>- Monitor electronic<br>- Handle media | Ingest Subsystem |
| Production Planning | Planning Subsystem |
| Resource Planning | Planning Subsystem<br>Systems Management Subsystem |
| Production Monitoring and control | Processing Subsystem |
| Archive Management | Data Server Subsystem |
| Data Distribution<br>- Monitor electronic<br>- Handle media | Data Server Subsystem |
| Resource Management | Processing, Ingest, Distribution & Data Server Subsystems in coordination with Systems Management Subsystem |
| Science software Integration Support | Processing Subsystem |
| Database Maintenance | Data Management Subsystem<br>Data Server Subsystem<br>Application specific (2) |
| System and Performance Analysis | Systems Management Subsystem |
| Security | Systems Management Subsystem |
| Accounting and Billing | Systems Management Subsystem |
| Sustaining Engineering | Office Support<br>Systems Management Subsystem<br>Communication Subsystem |
| S/W and H/W Maintenance | Office Support<br>Systems Management Subsystem<br>Communication Subsystem |
| Configuration Management (chg control) | Systems Management Subsystem |
| Testing, training, property management, integrated logistics support, library administration | Office Support<br>Systems Management Subsystem<br>Communication Subsystem |

Notes:

1. Capability used to support science software integration and testing for TRMM.

2. Included to ensure that the number of small DBMSs throughout the system are not explicitly excluded (e.g., Planning Subsystem has a DBMS)

## 3.2 MSFC External Interfaces

The MSFC ECS DAAC will interface with multiple external entities. The ECS subsystem-specific DID 305 design documents address the interfaces generically. For details, the reader is referred to those documents in addition to the various Interface Control Documents (ICDs). Figure 3.2-1 schematically illustrates the interfaces between the ECS subsystems at the MSFC ECS DAAC and its external entities (sinks and sources of data). The figure enumerates data flows which are elaborated upon in Table 3.2-1.

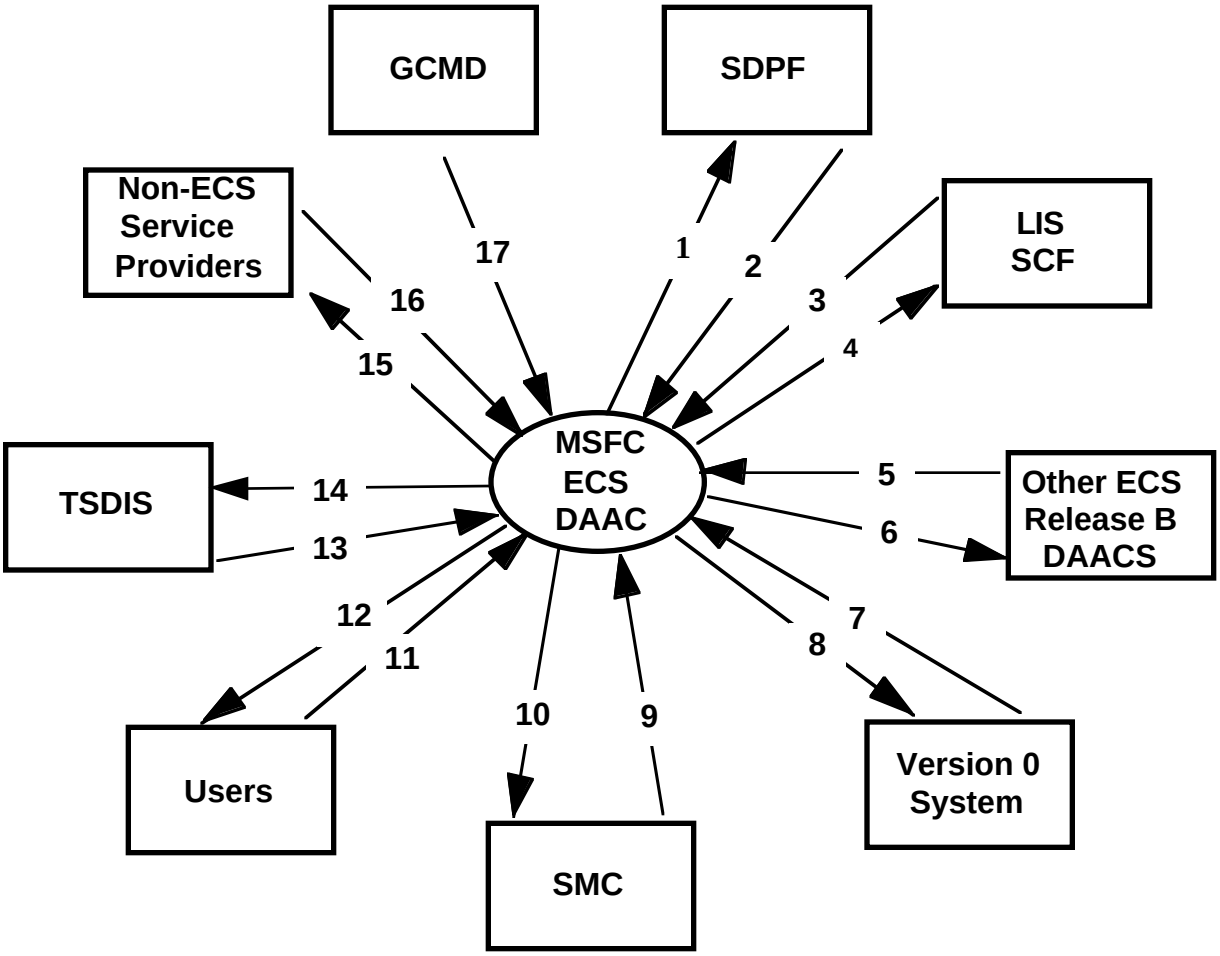


***Figure 3.2-1. MSFC ECS DAAC External Interfaces***

***Table 3.2-1. MSFC External Interfaces (1 of 6)***

| Flow No. | Source | Destination | Data Types | Data Volume | Frequency |
|---|---|---|---|---|---|
| 1 | Ingest | SDPF | L0 data | medium | as requested for reprocessing |
| 2 | SDPF | Ingest | L0 Data | Instrument Specific (CERES, LIS) | daily |
| 2 | SDPF | Ingest | Expedited Data | medium | three times a day |
| 2 | SDPF | Ingest | Predictive Orbit Data | medium | daily |
| 2 | SDPF | Ingest | Definitive Orbit Data | medium | daily |
| 2 | SDPF | Ingest | Back-up Data | medium | as required |
| 3 | SCF | Ingest | Status | low | as required |
| 3 | SCF | Ingest | Metadata/updates | low | as required |
| 3 | SCF | Ingest | Documents | low | as required |
| 3 | SCF | Ingest | Algorithms/Updates | medium | as required |
| 3 | SCF | Data Server | QA Data request | low | as required |
| 3 | SCF | Data Server | QA Data Subscription | low | as required |
| 4 | Data Server | SCF | Status | low | as required |
| 4 | Data Server | SCF | Metadata/updates | low | as required |
| 4 | Data Server | SCF | Calibration data | medium | as required |
| 4 | Data Server | SCF | Correlative data | medium | as required |
| 4 | Data Server | SCF | Documents | low | as required |
| 4 | Data Server | SCF | Algorithms/updates | medium | as required |
| 4 | Data Server | SCF | Standard Products | medium | daily as required for QA |
| 4 | Data Server | SCF | Standard Products | medium | daily as required for QA |
| 4 | CSS (DAAC Ops via email, EDHS) | SCF | Toolkit Delivery and Update Package | low | as required |
| 4 | CSS (DAAC Ops via email, kftp) | SCF | Test Results, QA, and Production History Data | low | as required |
| 4 | CSS (DAAC Ops via email, kftp) | SCF | Resource Usage | low | as required |
| 4 | CSS (DAAC Ops via email, kftp) | SCF | Status | low | as required |

***Table 3.2-1. MSFC External Interfaces (2 of 6)***

| Flow No. | Source | Destination | Data Types | Data Volume | Frequency |
|---|---|---|---|---|---|
| 5 | Other ECS DAACs | Ingest | Ancillary Data | high | as required |
| 5 | Other ECS DAACs | Ingest | Correlative Data | high | as required |
| 5 | Other ECS DAACs | Ingest | Calibration Data | medium | as required |
| 5 | Other ECS DAACs | Ingest | QA Data | medium | as required |
| 5 | Other ECS DAACs | Interoperability | Advertisements | medium | as required |
| 5 | Other ECS DAACs | Data Server | Result Sets | medium | as required |
| 5 | Other ECS DAACs | Client | Product Results | medium | as required |
| 6 | Data Server | Other ECS DAACs | Standard Products | high | as required |
| 6 | Data Server | Other ECS DAACs | Metadata | medium-high | as required |
| 6 | Data Server | Other ECS DAACs | Ancillary Data | high | as required |
| 6 | Data Server | Other ECS DAACs | Correlative Data | high | as required |
| 6 | Data Server | Other ECS DAACs | Calibration Data | high | as required |
| 6 | Data Server | Other ECS DAACs | Documents | medium | as required |
| 6 | Data Server | Other ECS DAACs | Orbit/Attitude Data | medium | as required |
| 6 | Data Server | Other ECS DAACs | Data Availability Schedules | medium | as required |
| 6 | Data Server | Other ECS DAACs | Algorithms | high | as required |
| 6 | Data Server | Other ECS DAACs | L0 Data | high | as required |
| 6 | Data Server | Other ECS DAACs | QA Data | medium | as required |
| 6 | Interoperability | Other ECS DAACs | Advertisements | medium | as required |
| 6 | Client | Other ECS DAACs | Product Requests | medium | as required |

***Table 3.2-1. MSFC External Interfaces (3 of 6)***

| Flow No. | Source | Destination | Data Types | Data Volume | Frequency |
|---|---|---|---|---|---|
| 7 | Version 0 System | Data Server | Inventory | low | as required |
| 7 | Version 0 System | Data Server | Guide | low | as required |
| 7 | Version 0 System | Data Server | Browse data | medium | as required |
| 7 | Version 0 System | Data Server | Dependent Valids | low | as required |
| 7 | Version 0 System | Data Management | V0 Directory search request | low | as requested |
| 7 | Version 0 System | Data Management | V0 Inventory search request | low | as requested |
| 7 | Version 0 System | Data Management | V0 browse request | low | as requested |
| 7 | Version 0 System | Data Management | V0 product order request | low | frequency dependent on user input |
| 7 | Version 0 System | Ingest | Ancillary Data for TSDIS | low | as requested |
| 7 | Version 0 System | Ingest | Migration Data | high | varies depending on migration strategy |
| 8 | Data Mgmt | Version 0 System | V0 Browse Result | low-medium | in response to ECS browse result |
| 8 | Data Mgmt | Version 0 | V0 inventory result set | low-high | in response to ECS inventory result request |
| 8 | Data Mgmt | Version 0 | V0 directory search result set | low-high | in response to ECS request |
| 8 | Data Mgmt | Version 0 System | V0 product order response | low | in response to product request result |
| 8 | Data Server | Version 0 System | Result Sets | medium-high | in response to request |
| 8 | Data Server | Version 0 System | Session Mgmt responses | low | in response to request |
| 8 | Data Server | Version 0 System | Product Request Status | low | as required |
| 9 | SMC | MSS | Policies | low | as required |
| 9 | SMC | MSS | Conflict Resolution | low | as required |
| 9 | SMC | MSS | Procedures | low | as required |
| 9 | SMC | MSS | Directives | low | as required |
| 10 | MSS | SMC | Conflict Resolution Request | low | as required |
| 10 | MSS | SMC | Status | low | as required |
| 10 | MSS | SMC | Performance | low | as required |

***Table 3.2-1. MSFC External Interfaces (4 of 6)***

| Flow No. | Source | Destination | Data Types | Data Volume | Frequency |
|---|---|---|---|---|---|
| 11 | Users | Client | User registration information | low | as requested |
| 11 | Users | Client | User login information | low | as requested |
| 11 | Users | Client | Search requests | low | as requested |
| 11 | Users | Client | Product requests | low | as requested |
| 11 | Users | Client | Acquisition requests | low | as requested |
| 11 | Users | Client | Desktop manipulate commands | low | as supplied by user |
| 11 | Users | Client | Configuration/Profile information | low | as supplied by user |
| 11 | Users | Client | Data manipulate requests | low | as requested |
| 11 | Users | Client | Command language request | low | as requested |
| 11 | Users | Client | Advertisements, Software, and Documents | low | as supplied by user |
| 11 | Users | Ingest | User Methods | medium | as required |
| 11 | Users | Ingest | Ingest Status Requests | low | as required |
| 12 | Data Server | Users | Metadata | low | as requested |
| 12 | Data Server | Users | Documents | low | as requested |
| 12 | Data Server | Users | Data Products | medium | as requested |
| 12 | Data Server | Users | Browse Products | medium | as required |
| 12 | Data Server | Users | Product Request Status | low | as requested |
| 12 | Data Server | Users | Schedules | low | as requested |
| 12 | Client | Users | Results Set | medium | as requested |
| 12 | Client | Users | Application user interfaces | low | as requested |
| 12 | Client | Users | Formatted data | medium | as requested |
| 12 | Client | Users | Desktop Objects | low | as requested |
| 12 | Client | Users | Advertisement and Software | low | as requested |
| 12 | Client | Users | Error and Status information | low | as available |
| 12 | Ingest | Users | Ingest Status | low | as requested |

## *Table 3.2-1. MSFC External Interfaces (5 of 6)*

| Flow No. | Source | Destination | Data Types | Data Volume | Frequency |
|---|---|---|---|---|---|
| 13 | TSDIS | Ingest | Metadata | 1 days worth of products | daily |
| 13 | TSDIS | Ingest | Ancillary Data (GV) | 1 days worth | daily |
| 13 | TSDIS | Ingest | Data Products (TMI,PR, combined) Levels 1A,1B,2A,2B, 3A, and 3B | 60 (GB/day) Processing and Reprocessing | |
| 13 | TSDIS | Ingest | Algorithms | medium | as required |
| 13 | TSDIS | Ingest | Documents | low | as required |
| 13 | TSDIS | Ingest | Status | low | as required |
| 13 | TSDIS | Ingest | Browse Data | high | daily |
| 13 | TSDIS | Ingest | Directory | low | as required |
| 13 | TSDIS | Ingest | Guide | low | as required |
| 13 | TSDIS | Ingest | Schedule Data | low | as required |
| 13 | TSDIS | Data Server | Subscription Data | low | as required |
| 14 | Data Server | TSDIS | Metadata | medium - 2 day's worth of archived data | daily |
| 14 | Data Server | TSDIS | Ancillary Data | high - enough to support 1 day of processing and 2 day's worth of reprocessing (~10 Gbytes) | frequency depends on data set |
| 14 | Data Server | TSDIS | Calibration Data | medium | included in ancillary data |
| 14 | Data Server | TSDIS | Correlative Data | medium | included in ancillary data |
| 14 | Data Server | TSDIS | Documents | low | as required |
| 14 | Data Server | TSDIS | Data Products | 2 days worth of archived data (~50 Gbyte) | daily |
| 14 | Data Server | TSDIS | Data Availability Notice | low | daily |
| 14 | Data Server | TSDIS | Status | low | as required |
| 14 | Data Server | TSDIS | Ancillary Data (GPCP,GPCC, SSM/I) | medium | as required for reprocessing |

***Table 3.2-1. MSFC External Interfaces (6 of 6)***

| Flow No. | Source | Destination | Data Types | Data Volume | Frequency |
|---|---|---|---|---|---|
| 14 | Data Server | TSDIS | Data Products (TMI,PR,GV combined) | high | as required for reprocessing |
| 15 | Interoperability | Non-ECS Service Providers | Notifications | low | in response to subscriptions |
| 16 | Non-ECS Service Providers | Interoperability | Advertisements | low-medium | as required |
| 16 | Non-ECS Service Providers | Interoperability | Subscriptions | low | as required |
| 17 | GCMD | Interoperability | Advertisements | low-medium | as required |

Notes: In the table, where an exact number is unavailable, the data volume is estimated as low (less than 1 MB), medium (between 1 MB and 1 GB), or high (greater than 1 GB) per use defined in the frequency column . The frequency information will be updated as the interfaces are fully defined.

The following further describes the external entities, including those identified to support interface testing:

- TSDIS – This interface primarily supports the transfer of data between the MSFC ECS DAAC and TSDIS for archival of TMI, PR and GV datasets including ancillary data, metadata and documentation. This data will be transferred back to TSDIS for reprocessing every six months. Further details can be found in the IRD between TRMM and ECS (ESDIS 505-41-14) and the ICD between ECS and TSDIS (209-CD-007-003).
- SDPF - This interface transmits the Level 0 LIS data, metadata, predictive orbit, definitive orbit, back up data and expedited data. It is almost a real time interface as there will be little delay between receipt at the SDPF and retransmission to the MSFC ECS DAAC. Further details on this and the TSDIS interface can be found in the ICD between SDPF and TRMM (560-203.103) and the ICD Between ECS and TSDIS (209-CD-007-003).
- LIS SCF – This interface supports the LIS Instrument Team. LIS Science software, metadata, status, quality control products, standard products, calibration data, correlative data, algorithm updates and documentation are examples of items that cross this interface. Further details can be found in the ICD between ECS and the SCF (209-CD-005-003).
- Other ECS DAACs - The MSFC ECS DAAC will interface with the GSFC, LaRC, EDC, ORNL, NSIDC, JPL and ASF ECS DAACs. All data products migrated from the V0 DAACs will be available from these DAACs for access by users. Guide, inventory, standard products and other related information, identified in Table 3.2-1, will flow across this interface.

- Version 0 - The migration of Version 0 datasets from the MSFC V0 DAAC into ECS will also occur via this interface. Three MSFC V0 data collections have been identified for migration during Release A. These data sets will be among the first maintained within the ECS Data Server paradigm, as described in section 3.3. Additional V0 products will migrate to ECS via this interface in Release B. This interface to the MSFC ECS DAAC supports access, using the Version 0 System IMS, to the V0 holdings that have not currently migrated to ECS. This interface is also used to support the interoperability required for cross-DAAC access.
- SMC - This interface provides the capability for the MSFC DAAC to receive performance information, processing status, scheduling and policy data and user registration information. Policy data includes that established by the ESDIS project. The MSFC DAAC sends it system performance and status reports to SMC as part of this interface.
- MSFC Users – This interface is the mechanism for user community access to ECS data and services. It is the mechanism by which advertisements, user registration, order and product status, desktop object manipulations, and command language capabilities are utilized.
- Non-ECS Service Providers - This interface is required for specialized users who use ECS data to provide and advertise value-added services. These providers include commercial, institution, or other government agencies, as well as IPs, SCFs, and ADCs.
- GCMD - The Global Change Master Directory (GCMD) is a multidisciplinary database of information about data holdings of potential interest to the scientific research community. It contains high level descriptions of data set holdings of various agencies and institutions. It also contains supplementary descriptions about these data centers, as well as scientific campaigns and projects, sources (spacecraft, platforms), and sensors. This interface will allow the MSFC ECS DAAC to import directory level information from the GCMD via GCMD export files and generate ECS data product advertisements.

## 3.3 Computer Software Component Analysis

The ECS software subsystems are described in detail in the ECS Subsystem-specific DID305 documents. This section provides a brief overview description of each of the subsystems, then as part of the analysis, addresses the CSCIs for each subsystem, focusing upon those CSCIs that are specific to the MSFC ECS DAAC. For the most part, the software is the same for all other DAACS. However, the content of databases and schema constructions may differ. In addition, the purchase of different COTS packages for the DAACs may be required.

### 3.3.1 Software Subsystem Overview

The 10 ECS software subsystems are described in detail in the ECS Subsystem-specific DID305 documents. This section provides a brief overview description of each of the subsystems.

**Client Subsystem (CLS)**: This software consists of graphic user interface (GUI) programs, tools for viewing and/or manipulating the various kinds of ECS data (e.g., images,

documents, tables) and libraries representing the client application program interface (API) of ECS services. The client subsystem components will be available to users for installation on their workstations and will also be deployed on workstations within the DAAC in support of normal operations, including User Services support.

**Interoperability Subsystem (IOS)**: The interoperability subsystem is an advertising service. It maintains a database of information about the services and data offered by ECS, and allows users to search through this database to locate services and data that may be of interest to them. Implemented as a Web server application with a DBMS back-end.

**Data Management Subsystem (DMS)**: This subsystem includes functions which provide uniform access to descriptions of the data and elements offered by the ECS repositories and provide a bi-directional gateway between ECS and Version 0. This subsystem also includes distributed search and retrieval functions and corresponding site interfaces.

**Data Server Subsystem (DSS)**: The subsystem provides the physical storage access and management functions for the ECS earth science data repositories. Other subsystems can access it directly or via the data management subsystem (if they need assistance with searches across several of these repositories). The subsystem also includes the capabilities needed to distribute bulk data via electronic file transfer or physical media. Other components include, administrative software to manage the subsystem resources and perform data administration functions (e.g., to maintain the database schema); and data distribution software, e.g., for media handling and format conversions. The main components of the subsystem are the following:

- database management system - uses an off-the-shelf DBMS (Illustra) to manage it's earth science data and implement spatial searching, as well as for the more traditional types of data (e.g., system administrative and operational data). It will use a document management system to provide storage and information retrieval for guide documents, scientific articles, and other types of document data.
- file storage management systems - used to provide archival and staging storage for large volumes of data. Provides hierarchical storage support and device/media independence to the remainder of DSS and ECS.
- data type libraries - they will implement functionality of earth science and related data that is unique and not available off-the-shelf (e.g., spatial search algorithms and translations among coordinate systems). The libraries will interface with the data storage facilities, i.e. the database and file storage management systems.

**Ingest Subsystem (INS)**: The subsystem deals with the initial reception of all data received at an ECS facility and triggers subsequent archiving and processing of the data. Given the variety of possible data formats and structures, each external interface, and each ad-hoc ingest task may have unique aspects. Therefore, the ingest subsystem is organized into a collection of software components (e.g., ingest management software, translation tools, media handling software) from which those required in a specific situation can be readily configured. The resultant configuration is called an ingest client. Ingest clients can operate on a continuous basis to serve a routine external interface or they may exist only for the duration of a specific ad-hoc ingest task.

**Data Processing Subsystem (DPS)**: The main components of the data processing subsystem - the science software - will be provided by the science teams. The data processing subsystem will provide the necessary hardware resources, as well as software for queuing, dispatching and managing the execution of the science software in an environment which will eventually be highly distributed and consist of heterogeneous computing platforms. The DPS also interacts with the DSS to cause the staging and de-staging of data resources in synchronization with processing requirements.

**Planning Subsystem (PLS)**: This subsystem provides the functions needed to pre-plan routine data processing, schedule ad-hoc processing, and dispatch and manage processing requests. The subsystem provides access to the data production schedules at each site, and provides management functions for handling deviations from the schedule to operations and science users.

**System Management Subsystem (MSS)**: The Management Subsystem (MSS) provides enterprise management (network, system and application management) for all ECS resources: commercial hardware (including computers, peripherals, and network routing devices), commercial software, and custom applications. Enterprise management reduces overall development and equipment costs, improves operational robustness, and promotes compatibility with evolving industry and government standards. Consistent with current trends in industry, the MSS thus manages both ECS's network resources per EBNET requirements and ECS's host/application resources per SMC requirements. Additionally MSS also supports many requirements allocated to SDPS and FOS for management data collection and analysis/distribution. The MSS allocates services to both the system-wide and local levels. With few exceptions, the management services will be fully decentralized and no single point of failure exists which would preclude user access. In principle, every service is distributed unless there is an overriding reason for it to be centralized. MSS has two key specializations: Enterprise Monitoring and Coordination Services, and Local System Management Services.

**Communications Subsystem (CSS)**: The CSS services include Object Services, Distributed Object Framework (DOF) and Common Facility Services. Support in this subsystem area is provided for peer-to-peer, advanced distributed, messaging, management, and event-handling communications facilities. These services typically appear on communicating end-systems across an internetwork and are not layered, but hierarchical in nature. Additionally, services to support communicating entities are provided, including directory, security, time, and other ancillary services. The services of the Communications Subsystem are functionally dependent on the services of the Internetworking Subsystem. The services of the common facility, object and DOF are the fundamental set of interfaces for all management and user access (i.e., pull) domain services.

**Internetworking Subsystem (ISS)**: The Internetworking Subsystem provides for the transfer of data transparently within the DAACs, SMC and EOC, and for providing interfaces between these components and external networks. ECS interfaces with external systems and DAAC-to-DAAC communications are provided by the EOSDIS Backbone Network (EBnet). EBnet's primary function is to transfer data between DAACs, including both product data and inter-DAAC queries and metadata responses. Other networks, such as NSI, will provide wide-area services to ECS. In addition, "Campus" networks, which form the existing networking infrastructure at the ECS locations, will provide connectivity to EOSDIS components such as SCFs and ISTs.

### 3.3.2 Software Subsystem Analysis Summary

The subsystems that comprise SDPS and CSMS have already been described in detail in companion IDR documents and have been summarized above. This section addresses the CSCIs from each subsystem and identifies their specificity as applicable to the ECS portion of the MSFC DAAC. Generally, the software is the same for all ECS DAACs. The content of databases and schema constructions may differ. In the case of OTS packages the possibility arises for the purchase of different versions for different DAAC hardware but even this will be extremely minimal for Release B. In this section, each of the subsystems will be addressed in a somewhat general manner to point out whether or not there are any MSFC DAAC specific portions.

- Client Subsystem - The client software will have no MSFC ECS DAAC specific portions, except for the possibility of different versions of COTS packages due to different types of hardware. Since the services offered by the client are required by operations, user services, and systems administrators the DAAC will have clients installed on several different ECS furnished workstations. In addition the DAAC may desire the client on some of their existing workstations to provide additional user access.

- Data Server -The software components of the Data Server Subsystem are largely the same for all Data Servers, at all DAACs. The two basic areas in which the Data Server Subsystem software will vary from DAAC to DAAC are configuration and special components.

  Data Server software is designed to be highly configurable in order to allow a wide variety of DAAC unique policy implementations. These unique configurations will enable the data server software installations to vary behavior, meeting the DAAC specific needs. Examples of configuration parameters include number of concurrent connections, number of requests per client, inactivity timeout period and allocation of software components to hardware.

  Another facet of the Data Server Subsystem software that supports the specific DAAC capabilities is in which actual components are installed at the ECS portion of the DAAC. These opportunities for DAAC specificity are driven by the types of distribution available to the DAACs data server clients and in the types of data (and their data type services) available. There will be portions of the Data Server software specific to the MSFC DAAC that are used to aid special distribution devices.

However, the primary portion of the Data Server Subsystem software that will be specific to the MSFC DAAC will be the specific data types supported at the DAAC. These software components are a portion of the Science Data Server (SDSRV) CSCI. The SDSRV is designed to allow complete flexibility in the data types (specifically, Earth Science Data Types, or ESDTs) that offer their services via the Data Server. Examples of services offered by ESDTs include Insert, Acquire, Browse and SpatialSubset. These data types are organized by separate CSCs, generally one per source instrument. Table 3.3.2-1 specifies the data types, or ESDTs that are being designed to be offered by the MSFC DAAC. For each ESDT at the MSFC DAAC, this table includes the CSC design entity, the ESDT name, the science product name and the product level where applicable. This table lists all intermediate LIS products, the majority of which are not archived, which are used in LIS processing. In order to enable the reader to relate products to details in the technical base line, the SPSO Parameter number is provided where available with the appropriate ESDT.

***Table 3.3.2-1 MSFC Data Types (1 of 4)***

| CSC | ESDT (SPSO Parameter) | Product Name | Level |
|---|---|---|---|
| GEOS | none available | Gridded Monthly Satellite Derived Estimates of Rainfall | 3 |
| In situ Data | none available | Ground Validation Product Level 2A Rainfall Existence Product | 2A |
| In situ Data | none available | Ground Validation Product Level 2A Single Site Surface Rainfall Product | 2A |
| In situ Data | none available | Ground Validation Product Level 2A Conv/Stratiform Rainfall | 2A |
| In situ Data | none available | Ground Validation Product Level 2A Single Site 3-D Reflectivity Map | 2A |
| In situ Data | none available | Ground Validation Product, Level 2A Rain Gauge-derived Rain Rates | 2A |
| In situ Data | none available | Ground Validation Level 2A Disdrometer (Raindrop size distrib.) Product | 2A |
| In situ Data | none available | Ground Validation Product, 5-Day Site Rainfall Map | 3 |
| In situ Data | none available | Ground Validation Product, Monthly Site Rainfall Map | 3 |
| In situ Data | none available | Ground Validation Product, Monthly accum. of 3D Hydrometeor Profile Structure | 2 |
| In situ Data | none available | TRMM Ground Validation Radar Site Browse Product | 3 |
| LIS | LIS01 (4357) | Calibration Lookup table for Lightning Event stream data | N/A |
| LIS | LIS01 (4357) | Calibration Lookup table for Lightning Background stream data | N/A |

***Table 3.3.2-1 MSFC Data Types (2 of 4)***

| CSC | ESDT (SPSO Parameter) | Product Name | Level |
|---|---|---|---|
| LIS | LIS02, LIS03, LIS04 | LIS Level 1B, 2 & 3 Background, Event, Group, Flash, Area and Flash Density products in Orbit-level LIS HDF data structure | 1B, 2&3 |
| LIS | LIS02, LIS03, LIS04 | LIS Level 1B, 2 & 3 Background, Event, Group, Flash, Area and Flash Density products with level of errors requiring SCF QA | 1B, 2&3 |
| LIS | LIS04 | LIS Level 3 15-Day Flash Density Product | 3 |
| LIS | LIS04 | LIS Level 3 30-Day Flash Density Product | 3 |
| LIS | | Level 0 Raw Packets | 0 |
| LIS | | User parameter file for setting level of raw packet filtering | N/A |
| Other | N/A | TRMM Platform Data needed for LIS processing | 0 |
| Other | N/A | TRMM Platform Definite Orbit Data needed for LIS processing (from FDF) | 0 |
| Other | none available | Level 1B Ground Validation Radar Calibration Data | 1B |
| Other | none available | Level 1C Ground Validation Radar Data | 1C |
| Other and Satellite Data | none available | Gridded Monthly Rainfall Totals from Gauge Data and other sources | 3 |
| PR | none available | Level 1A PR data from TRMM Satellite | 1A |
| PR | none available | Level 1B PR Data from TRMM Satellite | 1B |
| PR | none available | Level 1C PR Reflectivity Data from TRMM Satellite | 1C |
| PR | none available | Level 2A PR Sigma Zero (Surface reflectivity) Product | 2A |
| PR | none available | Level 2A PR Qualitative 2-D Surface Rainfall | 2A |
| PR | none available | Level 2A PR Radar Range Profiles | 2A |
| PR | none available | Level 3 Monthly PR Rainfall Structure Profiles | 3 |
| PR | none available | Level 3 Monthly PR Accumulated Surface Rainfall (Statistical Method) | 3 |
| PR | none available | PR Browse Product | 3 |

***Table 3.3.2-1 MSFC Data Types (3 of 4)***

| CSC | ESDT (SPSO Parameter) | Product Name | Level |
|---|---|---|---|
| PR, VIRS, TMI and Others | none available | Level 3B Surf. Rainfall Products (comb. of TRMM, GOES IR & SSM/I est.) | 3 |
| PR, VIRS, TMI and Others | none available | Browse Product from TMI, VIRS and PR Combined | 3 |
| PR, VIRS. TMI and others | none available | Level 3B Combined-TRMM and GOES IR Rainfall Products | 3 |
| SSM/I | | SSM/I Brightness Temps archived at the Marshall DAAC (used for product dev./valid by TSDIS) | 1B |
| TMI | none available | Level 1A TMI data from TRMM Satellite | 1A |
| TMI | none available | Level 1B TMI Brightness Temp Data from TRMM Satellite | 1B |
| TMI | none available | Level 2A TMI Surf. Rainfall & Hydrometeor Profile Product | 2A |
| TMI | none available | Level 3A TMI Monthly Emission-based Surf. Rainfall Product | 3 |
| TMI | none available | TMI Browse Product | 3 |
| TMI(TRMM) | CERX08 | Microwave Water Path | 1B |
| TMI, PR | none available | Combined TMI and PR Level 2A Surf. Rainfall & Hydrometeor Profiles | 2B |
| TMI, PR | none available | Combined TMI and PR Level 3B Surf. Rainfall & Hydrometeor Profiles | 3 |
| LIS | LIS01 (4356) | Raw Lightning Data Stream file | 1A |
| LIS | LIS01 (4356) | Raw Background Image Data Stream file | 1A |
| LIS | LIS01 (4356) | Raw Lightning Data Stream file with level of errors requiring SCF QA | 1A |
| LIS | LIS01 (4356) | Raw Background Image Data Stream file with level of errors requiring SCF QA | 1A |
| LIS | LIS01 (4356) | Filtered Lightning Data Stream file | 1A |
| LIS | LIS01 (4356) | Filtered Background Image Data Stream file | 1A |
| LIS | LIS01 (4356) | Filtered Lightning Data Stream file with level of errors requiring SCF QA | 1A |

***Table 3.3.2-1 MSFC Data Types (4 of 4)***

| CSC | ESDT (SPSO Parameter) | Product Name | Level |
|---|---|---|---|
| LIS | LIS01 (4356) | Filtered Background Image Data Stream file with level of errors requiring SCF QA | 1A |
| LIS | N/A | Orbit-Level Geolocated, filtered lightning event stream file | 1B |
| LIS | N/A | Orbit-Level Geolocated, filtered lightning event stream file with levels of error requiring SCF QA | 1B |
| LIS | | ASCII descriptions of Raw Packet Errors | N/A |
| LIS | | Binary file of Raw Packet Correction Script | N/A |
| LIS | | Header file of data boundaries and statistics | N/A |
| LIS | | ASCII Notice File created during LIS L0 Raw Packets-to-Stream Processing | N/A |
| LIS | | Header file of data boundaries and statistics | N/A |
| LIS | | ASCII Notice File from generation of Filtered Stream file | N/A |
| LIS | | Geolocated Event Data Stream file | 1B |
| LIS | | Geolocated Background Data Stream file | 1B |
| LIS | | Geolocated Event Data Stream file with level of errors requiring SCF QA | 1B |
| LIS | | Geolocated Background Data Stream file with level of errors requiring SCF QA | 1B |
| LIS | | Header file of data boundaries and statistics | N/A |
| LIS | | ASCII Notice File from generation of Geolocated Event & Background Data stream files | N/A |
| LIS | | Orbit-level Geolocated Lightning Event Data Stream file | 1B |
| LIS | | Orbit-level Gelocated Background Data Stream file | 1B |
| LIS | | Orbit-level Geolocated Lightning Event Data Stream file with level of errors requiring SCF QA | 1B |
| LIS | | Orbit-level Geolocated Background Data Stream file with level of errors requiring SCF QA | 1B |
| LIS | | Header file of data orbit boundaries and statistics | N/A |
| LIS | | ASCII Notice File from generation of Orbit-level Event & Background Data files | N/A |
| LIS | | ASCII Notice File created during generation of Orbit-level LIS HDF data structures | N/A |
| TBD | TBD | Version 0 ** | TBD |

** This information is dependent upon V0 data migration planning currently in progress

- Data Management - None of the data management software will be specific to the MSFC ECS DAAC. The V0 Gateway (GTWAY) will interface with the data servers at each site. Local and cross-DAAC searches are provided via capabilities resulting from integrating the components from the V0 System IMS into ECS.
- Ingest - The software for ingest at MSFC may differ from those of other DAACs because of dataset dependencies and differences related to non-homogeneous computer hardware across the Release B DAACS. Data ingestion procedures must match the peculiarities of the ingested data sets. Several types of ingest clients are described in the Ingest Subsystem companion document.
- Interoperability - There are no MSFC DAAC specific portions of the Interoperability Subsystem.
- Production Planning - While it is expected that the actual development code and COTS packages required for the MSFC ECS DAAC will not be unique, there will be a considerable amount of configuration and database information that will be specific. This information traditionally has not been included in counts for lines of developed code. The production plans developed for each DAAC will be different. Scripts, while they may use the same language, will be different and will trigger different responses in response to faults and other error conditions .
- Data Processing - Due to dataset characteristics there will be some specific software for MSFC in the area of Science Data Processing. In addition, as with the data server and ingest subsystems, differences in hardware types, driven by algorithm requirements, will also result in some differences in software.
- Communications Subsystem - There are no MSFC ECS DAAC specific portions of the Communications Subsystem.
- Management Subsystem - There are no MSFC ECS DAAC specific portions of the Internetworking Subsystem.
- Internetworking Subsystem - There are no MSFC ECS DAAC specific portions of the Internetworking Subsystem.

Table 3.3.2-1 lists the ECS subsystems and associated CSCIs and CSCs. For each CSC, there is an indication of the type of component. As defined in the DID 305 subsystem-specific documents, type indicates whether the component is custom developed (DEV), off the shelf (OTS), a CSC reused from another subsystem (reuse), a wrapper (WRP) that encapsulates OTS, or a combination of these types. The Use column indicates whether a generic-for-all-DAACs (Gnrc) form of the CSC is implemented or specific (Spfc) tailoring or use is required at a DAAC. The Notes column is included to comment about the characteristics of the system, data, and/or software that makes the CSC specific, as well as to provide any additional information about the generic CSCs. The OTS products are listed in this column.

***Table 3.3.2-2. MSFC Components Analysis (1 of 10)***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| Client | DESKT | Desktop Manager | Dev | Gnrc | |
| Client | WKBCH | Hypertext Viewer | OTS | Gnrc | OTS - TBD |
| Client | WKBCH | Earth Science Search Tool | OTS/Dev | Gnrc | OTS - TBD |
| Client | WKBCH | Product Request Tool | DEV | Gnrc | |
| Client | WKBCH | Release A Client | OTS | Gnrc | Release A Version of System V0 Client. |
| Client | WKBCH | Document Search Tool | OTS | Gnrc | OTS - TBD |
| Client | WKBCH | Advertising Client Tool | DEV | Gnrc | |
| Client | WKBCH | User Registration Tool | DEV | Gnrc | |
| Client | WKBCH | User Preferences Tool | DEV | Gnrc | |
| Client | WKBCH | Data Acquisition Tool | DEV | Gnrc | |
| Client | WKBCH | E-mailer Tool | DEV | Gnrc | |
| Client | WKBCH | Logger/Reviewer Tool | DEV | Gnrc | |
| Client | WKBCH | Data Dictionary Tool | DEV | Gnrc | |
| Client | WKBCH | Comment/Survey Tool | OTS/DEV | Gnrc | |
| Client | WKBCH | Visualization Tool | OTS | Gnrc | |
| Client | WKBCH | News Reader Tool | OTS | Gnrc | |
| Client | WKBCH | Hypertext Authoring Tool | OTS | Gnrc | |
| CSS | DCCI | Directory/Naming Services | OTS/Dev | Gnrc | OODCE |
| CSS | DCCI | DOF Services | OTS | Gnrc | OODCE |
| CSS | DCCI | Electronic Mail Services | OTS/Dev | Gnrc | native operating system |
| CSS | DCCI | Event Logger Services | Dev | Gnrc | |
| CSS | DCCI | File Access Services | OTS/Dev | Gnrc | ftp (native operating system) and kftp (public domain) |
| CSS | DCCI | Life Cycle Services | OTS/Dev | Gnrc | OODCE |
| CSS | DCCI | Message Passing Services | Dev | Gnrc | Developed with OODCE |
| CSS | DCCI | Security Services | OTS/ Dev | Gnrc | OODCE |
| CSS | DCCI | Thread Services | OTS | Gnrc | OODCE |
| CSS | DCCI | Time Services | OTS/Dev | Gnrc | OODCE |
| CSS | DCCI | Virtual Terminal Services | OTS | Gnrc | native operating system |
| Data Management | DDICT | Data Dictionary Server | DEV | Gnrc | |
| Data Management | DDICT | Data Dictionary DBMS | OTS | Gnrc | |
| Data Management | DIMGR | Distributed Information Manager | OTS/Dev | Gnrc | OTS - TBD |

***Table 3.3.2-2. MSFC Components Analysis (2 of 10)***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| Data Management | GTWAY | Gateway DBMS | OTS | Gnrc | Sybase DBMS |
| Data Management | GTWAY | Gateway Server | Dev | Gnrc | |
| Data Management | GTWAY | GCMD Exporter | Dev | Gnrc | |
| Data Management | GTWAY | Web Server | OTS | Gnrc | OTS - TBD |
| Data Management | LIMGR | LIM Server | DEV | Gnrc | |
| Data Management | LIMGR | LIM DBMS | OTS | Gnrc | OTS - TBD |
| Data Management | DIMGR | DIM Server | DEV | Gnrc | |
| Data Management | DIMGR | DIM DBMS | OTS | Gnrc | OTS - TBD |
| Data Processing | AITTL | Binary File Comparison Utility | Dev | Gnrc | |
| Data Processing | AITTL | Code Analysis Tools | OTS | Spfc | CASEVision<br>SPARCWorks<br>Specific for science software language. |
| Data Processing | AITTL | Data Visualization Tools | OTS/DEV | Gnrc | IDL |
| Data Processing | AITTL | Documentation Viewing Tools | OTS | Gnrc | SoftWindows/MS Office<br>Ghostview |
| Data Processing | AITTL | ECS HDF Visualization Tools | Dev | Gnrc | Reused from Client subsystem, WKBCH CSCI, Data Visualization (EOSView) CSC |
| Data Processing | AITTL | HDF File Comparison Utility | Dev/OTS | Gnrc | Custom IDL program |
| Data Processing | AITTL | PGE Processing GUI | Dev | Gnrc | |
| Data Processing | AITTL | PGE Registration GUI | Dev | Gnrc | |
| Data Processing | AITTL | Product Metadata Display Tool | ReuseDev | Gnrc | Reused from Data Processing subsystem, AITTL CSCI, HDF File Comparison Utility CSC |

***Table 3.3.2-2. MSFC Components Analysis (3 of 10 )***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| Data Processing | AITTL | Profiling Tools | OTS | Spfc | CASEVision<br>Specific for science software language. |
| Data Processing | AITTL | Report Generation Tools | OTS/Dev | Gnrc | OTS: SoftWindows/MS Office,<br>Dev: SSI&T manager |
| Data Processing | AITTL | SDP Toolkit-related Tools | Dev | Gnrc | |
| Data Processing | AITTL | SSAP Processing GUI | Dev | Gnrc | |
| Data Processing | AITTL | Standards Checkers | OTS/Dev | Spfc | FORCHECK for Fortran 77; otherwise, native compilers and UNIX lint. Specific for science software language. |
| Data Processing | AITTL | Update Data Server GUI | DEV | Gnrc | |
| | | Update PGE Database GUI | DEV | Gnrc | |
| Data Processing | PRONG | COTS | OTS | Gnrc | AutoSys and AutoXpert. |
| Data Processing | PRONG | COTS Management | Dev | Gnrc | |
| Data Processing | PRONG | Data Management | Dev | Gnrc | |
| Data Processing | PRONG | Data Pre-Processing | Dev | Spfc | Specific based on uniqueness of ancillary data products |
| Data Processing | PRONG | PGE Execution Management | Dev | Gnrc | |
| Data Processing | PRONG | Quality Assurance Monitor Interface | Dev/OTS | Spfc | Specific based on uniqueness of Science software and SCF-DAAC relationship |
| Data Processing | PRONG | Resource Management | Dev | Gnrc | |
| Data Processing | SDPTK | Ancillary Data Access | Dev/OTS | Gnrc | OTS - TBD |
| Data Processing | SDPTK | Celestial Body Position | Dev/OTS | Gnrc | OTS - TBD |
| Data Processing | SDPTK | Constant and Unit Conversions | Dev/OTS | Gnrc | OTS - TBD |

***Table 3.3.2-2. MSFC Components Analysis (4 of 10)***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| Data Processing | SDPTK | Coordinate System Conversion | Dev | Gnrc | |
| Data Processing | SDPTK | EOS-HDF | Dev | Gnrc | |
| Data Processing | SDPTK | Spacecraft Ephemeris and Attitude Access | Dev/OTS | Gnrc | OTS - TBD |
| Data Processing | SDPTK | Geo Coordinate Transformation | Dev/OTS | Gnrc | OTS - TBD |
| Data Processing | SDPTK | Graphics Library | OTS | Gnrc | IDL |
| Data Processing | SDPTK | File Input/Output Tools | Dev | Gnrc | |
| Data Processing | SDPTK | Math Package (IMSL) | OTS | Gnrc | IMSL |
| Data Processing | SDPTK | Memory Management | Dev | Gnrc | |
| Data Processing | SDPTK | Metadata Access | Dev | Gnrc | |
| Data Processing | SDPTK | Process Control | Dev | Gnrc | |
| Data Processing | SDPTK | Time Date Conversion | Dev | Gnrc | |
| Data Server | DDIST | Distribution Client Interface | Dev | Gnrc | |
| Data Server | DDIST | Distribution Products | Dev | Gnrc | |
| Data Server | DDIST | Distribution Request Mgmt | Dev | Gnrc | |
| Data Server | DDSRV | DDSRV | Dev | Gnrc | |
| Data Server | DDSRV | DDSRV Client | Dev//OTS | Gnrc | HTTP libraries |
| Data Server | DDSRV | DDSRV CSDT | Dev/OTS | Gnrc | Rogue Wave class libr. |
| Data Server | DDSRV | DDSRV ESDT | Dev/OTS | Gnrc | Rogue Wave class libr. |
| Data Server | DDSRV | DDSRV Search Engine | DEV | Gnrc | Text Search Indexor and HTTP server |
| Data Server | DDSRV | DDSRV Server | Dev | Gnrc | |
| Data Server | SDSRV | Administration &Operations | Dev | Gnrc | |
| Data Server | SDSRV | Client | Dev/OTS | Gnrc | Rogue Wave class libraries and OODCE |
| Data Server | SDSRV | Configuration and Startup | Dev | Gnrc | |
| Data Server | SDSRV | CSDT | DEV/OTS | Gnrc | HDF-EOS |
| Data Server | SDSRV | DB Wrappers | DEV/OTS | Gnrc | Illustra DBMS |
| Data Server | SDSRV | Descriptors | Dev | Gnrc | Rogue Wave class libraries |

***Table 3.3.2-2. MSFC Components Analysis (5 of 10)***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| Data Server | SDSRV | General ESDT | Dev | Gnrc | |
| Data Server | SDSRV | Global | Dev/OTS | Gnrc | Rogue Wave class libraries |
| Data Server | SDSRV | GUI | Dev/OTS | Gnrc | |
| Data Server | SDSRV | LIS | Dev | Spfc | |
| Data Server | SDSRV | Metadata | Dev/Wrpr | Gnrc | Illustra DBMS |
| Data Server | SDSRV | Non-Product Science ESDT | Dev | Gnrc | |
| Data Server | SDSRV | Non-Science ESDT | Dev | Gnrc | |
| Data Server | SDSRV | New ESDTs | DEV | Gnrc | |
| Data Server | SDSRV | PR | Dev | Spfc | |
| Data Server | SDSRV | Instruments | Dev | Spfc | |
| Data Server | SDSRV | Server | Dev/OTS | Gnrc | Rogue Wave class libraries |
| Data Server | SDSRV | Subscriptions | Dev/OTS | Gnrc | Rogue Wave class libraries |
| Data Server | SDSRV | TMI | Dev | Spfc | |
| Data Server | STMGT | Service Clients | Dev/OTS | Gnrc | CSC encapsulates the AMASS OTS product (Data Server subsystem, STMGT CSCI, Data Storage CSC) . Also Rogue Wave class libraries. |
| Data Server | STMGT | Data Storage | Dev/OTS | Gnrc | AMASS File Storage Management System |
| Data Server | STMGT | File | Dev | Gnrc | |
| Data Server | STMGT | Peripherals | Dev | Gnrc | This CSC encapsulates the CSS-supplied API which supports the OTS FTP product. |
| Data Server | STMGT | Resource Management | Dev | Gnrc | |
| Ingest | INGST | Client | Reuse | Gnrc | |
| Ingest | INGST | Data Storage | Reuse | Gnrc | Reused from Data Server subsystem, SDSRV CSCI, CSC and STMGT CSCI |
| Ingest | INGST | Ingest Administration Data | Dev | Gnrc | |

***Table 3.3.2-2. MSFC Components Analysis (6 of 10)***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| Ingest | INGST | Ingest Data Preprocessing | Dev | Spfc | Specific based on uniqueness of ingested data and preprocessing requirements. |
| Ingest | INGST | Ingest Data Transfer | Dev | Gnrc | |
| Ingest | INGST | Ingest DBMS | OTS | Gnrc | Sybase DBMS |
| Ingest | INGST | Ingest Request Processing | Dev | Gnrc | |
| Ingest | INGST | Ingest Session Manager | Dev | Gnrc | |
| Ingest | INGST | Operator Ingest Interfaces | Dev | Gnrc | |
| Ingest | INGST | Polling Ingest Client Interface | Dev | Gnrc | |
| Ingest | INGST | Resource Management | Reuse | Gnrc | Reused from Data Server subsystem, SDSRV CSCI, ?CSC and STMGT CSCI, ? CSC |
| Ingest | INGST | User Network Ingest Interface | Dev | Gnrc | |
| Ingest | INGST | Viewing Tools | Reuse | Gnrc | Reused from Client subsystem, WKBCH CSCI, Data Visualization (EOSView) CSC |
| Ingest | INGST | Configuration/Startup | Reuse | Gnrc | |
| Ingest | INGST | Metadata | Reuse | Gnrc | |
| Ingest | INGST | CSDT | Reuse | Gnrc | |
| Ingest | INGST | DB Wrappers | Reuse | Gnrc | |
| Ingest | INGST | Descriptors | Reuse | Gnrc | |
| Ingest | INGST | General ESDT | Reuse | Gnrc | |
| Ingest | INGST | Global | Reuse | Gnrc | |
| Ingest | INGST | GUI | Reuse | Gnrc | |
| Ingest | INGST | LIS | Reuse | spcf | |
| Ingest | INGST | Non-Product Science ESDTs | Reuse | Gnrc | |
| Ingest | INGST | Non-Science ESDTs | Reuse | Gnrc | |
| Ingest | INGST | Server | Reuse | Gnrc | |
| Ingest | INGST | Subscriptions | Reuse | Gnrc | |
| Ingest | INGST | Service Clients | Reuse | Gnrc | |
| Ingest | INGST | File | Reuse | Gnrc | |
| Ingest | INGST | Distribution Products | Reuse | Gnrc | |

***Table 3.3.2-2. MSFC Components Analysis (7 of 10)***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| Ingest | INGST | Distribution Client Interface | Reuse | Gnrc | |
| Ingest | INGST | Distribution Request Management | Reuse | Gnrc | |
| Interoperability | ADSRV | AdvDBMSApplServer | Dev | Gnrc | |
| Interoperability | ADSRV | AdvDBMSServer | OTS | Gnrc | Sybase DBMS |
| Interoperability | ADSRV | AdvTextServer | OTS | Gnrc | Reused from Data Server subsystem, DDSRV CSCI, Search CSC, text search indexor |
| Interoperability | ADSRV | AdvNavigatingServer | OTS | Gnrc | Reused from Data Server subsystem, DDSRV CSCI, Search CSC, HTTP server |
| ISS | INCI | Datalink/Physical | OTS | Gnrc | firmware, vendor-supplied with hardware |
| MSS | MACI | Application MIB | Dev | Gnrc | |
| MSS | MACI | DCE Proxy Agent | Dev | Gnrc | |
| MSS | MACI | ECS Subagent | Dev or OTS/ Dev | Gnrc | |
| MSS | MACI | Encapsulator for non-Peer Agent | OTS/Dev | Gnrc | OTS - TBD |
| MSS | MACI | Extensible SNMP Master Agent | OTS/Dev | Gnrc | Peer Network's agent, along with its toolkit for Dev |
| MSS | MACI | Instrumentation Class Library | Dev | Gnrc | |
| MSS | MACI | SNMP Manager's Deputy | Dev | Gnrc | |
| MSS | MCI | Accountability Manager | Dev | Gnrc | |
| MSS | MCI | Accountability Proxy Agent | DEV | Gnrc | |
| MSS | MCI | Application Management | Dev | Gnrc | |
| MSS | MCI | Automatic Actions | Dev | Gnrc | |
| MSS | MCI | BAAC Configuration (Billing And ACount.) | Dev | Gnrc | |
| MSS | MCI | BAAC Manager | OTS | Gnrc | OTS - TBD |
| MSS | MCI | BAAC Proxy Agent | Dev | Gnrc | |
| MSS | MCI | DCE Cell Management | OTS | Gnrc | HAL DCE Cell Manager |

***Table 3.3.2-2. MSFC Components Analysis (8 of 10)***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| MSS | MCI | Diagnostic Tests | OTS | Gnrc | vendor-supplied with hardware |
| MSS | MCI | Management Data Access Services | Dev | Gnrc | |
| MSS | MCI | Management Data Access User Interface | Dev | Gnrc | |
| MSS | MCI | Management DBMS | OTS | Gnrc | Sybase DBMS |
| MSS | MCI | Management DBMS Proxy Agent | Dev | Gnrc | |
| MSS | MCI | Management Framework | OTS | Gnrc | HP OpenView Network Node Manager |
| MSS | MCI | Management Proxy | Dev | Gnrc | |
| MSS | MCI | Mode Management | Dev | Gnrc | |
| MSS | MCI | Network Manager | OTS | Gnrc | HP OpenView Network Node Manager |
| MSS | MCI | Performance Management Proxy | Dev | Gnrc | |
| MSS | MCI | Performance Manager | OTS/Dev | Gnrc | OTS - TBD |
| MSS | MCI | Performance Test | OTS | Gnrc | vendor-supplied with hardware |
| MSS | MCI | Performance Trending | Dev | Gnrc | |
| MSS | MCI | Physical Configuration Manager | OTS | Gnrc | Mountain View |
| MSS | MCI | Physical Configuration Proxy Agent | Dev | Gnrc | |
| MSS | MCI | Report Generation and Distribution | Dev | Gnrc | |
| MSS | MCI | Report Generation Manager | Dev | Gnrc | |
| MSS | MCI | Report Generation Proxy Agent | Dev | Gnrc | |
| MSS | MCI | Report Generation User Interface | Dev | Gnrc | |
| MSS | MCI | Report Generator | OTS | Gnrc | No decision yet, evaluation in progress |
| MSS | MCI | Resource Class Category | Dev | Gnrc | |

***Table 3.3.2-2. MSFC Components Analysis (9 of 10)***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| MSS | MCI | Security Databases | OTS | Gnrc | Operating System Password Files, DCE Registry Database, Router Configuration Files, TCP Wrappers configuration files, Operating System Access Control Lists, DCE Access Control Lists |
| MSS | MCI | Security Management Proxy Agent | Dev | Gnrc | |
| MSS | MCI | Security Manager | Dev | Gnrc | |
| MSS | MCI | Security Tests | OTS | Gnrc | CRACK, COPS, SATAN, TRIPWIRE |
| MSS | MCI | Transaction Generator | Dev | Gnrc | |
| MSS | MCI | Trouble Ticketing Management Services | OTS | Gnrc | Remedy Action Request System |
| MSS | MCI | Trouble Ticketing Proxy Agent | Dev | Gnrc | |
| MSS | MCI | Trouble Ticketing Service Requester | Dev | Gnrc | |
| MSS | MCI | Trouble Ticketing User Interface | Dev | Gnrc | |
| MSS | MCI | User Profile Server | Dev | Gnrc | |
| MSS | MLCI | Baseline Manager | OTS/Dev | Gnrc | |
| MSS | MLCI | Change Request Manager | OTS/Dev | Gnrc | Distributed Defect Tracking System |
| MSS | MLCI | Inventory Manager | OTS/Dev | Gnrc | |
| MSS | MLCI | License Manager | OTS/Dev | Gnrc | |
| MSS | MLCI | Logistics Manager | OTS/Dev | Gnrc | |
| MSS | MLCI | Maintenance Manager | OTS/Dev | Gnrc | |
| MSS | MLCI | Policies and Procedures Manager | OTS/Dev | Gnrc | |
| MSS | MLCI | Software Change Manager | OTS/Dev | Gnrc | ClearCase |
| MSS | MLCI | Software Distribution Manager | OTS/Dev | Gnrc | |
| MSS | MLCI | Training Manager | OTS/Dev | Gnrc | |
| Planning | PLANG | On Demand Manager | DEV | Gnrc | |
| Planning | PLANG | PDPS DBMS | OTS/DEV | Gnrc | Sybase DBMS |

***Table 3.3.2-2. MSFC Components Analysis (10 of 10)***

| Subsystem | CSCI | CSC | TYPE | USE | NOTES |
|---|---|---|---|---|---|
| Planning | PLANG | Planning Object Library | OTS | Gnrc | Delphi C++ class libraries |
| Planning | PLANG | Production Planning Workbench | Dev | Gnrc | |
| Planning | PLANG | Production Request Editor | Dev | Gnrc | |
| Planning | PLANG | Subscription Editor | Dev | Gnrc | |
| Planning | PLANG | Subscription Manager | Dev | Gnrc | |

## 3.4 DAAC Hardware and Network Design

This section provides an overview of the hardware configuration currently envisioned to support the Release B ECS mission objectives at the MSFC DAAC. Included below are details with respect to the Release B LANs (within Section 3.4.1), the SDPS and remaining CSMS hardware (within Section 3.4.2). The LAN configuration discussion provides an overview diagram, Figure 3.4.1-1, which focuses on the MSFC configuration from the "networks" point of view. The remaining hardware discussions include an overview of the processing, server, workstation and associated peripherals with an overview diagram, Figure 3.4.2-1, providing details on sizes, quantities, classes and in most cases vendor and model numbers.

Note that the recommended configurations are based on on-going design and/or prototyping analysis which will continue through CDR. Some design analysis is still proceeding on the incremental development track which relies heavily on prototyping. As further prototyping and design analysis is performed, the ECS Team will continue to perform cost /performance analysis that is expected to impact the recommended configurations presented in this document. Therefore, "selected" make and model numbers are subject to change.

The following subsections provide details of the design *rationale* and recommended *configuration* for each of the CSMS and SDPS subsystems.

### 3.4.1 MSFC DAAC LAN Configuration

The Release B MSFC DAAC LAN design builds upon the design for Release A. The major design drivers and rational for the Release A design are presented in the Release A MSFC DAAC Design Specification (305-CD-016-001), and that document may provide useful background information and context for the current Release B design.

The MSFC DAAC LAN topology is illustrated in Figure 3.4.1-1. The topology consists of a User FDDI Network and a Production FDDI Network (the data flows required for processing do not require a HiPPI Network). The creation of separate User and Processing networks allows processing flows to be unaffected by user pull demands, and the FDDI-based Production Network provides adequate bandwidth to the DAAC subsystems. Each network is discussed in detail below.

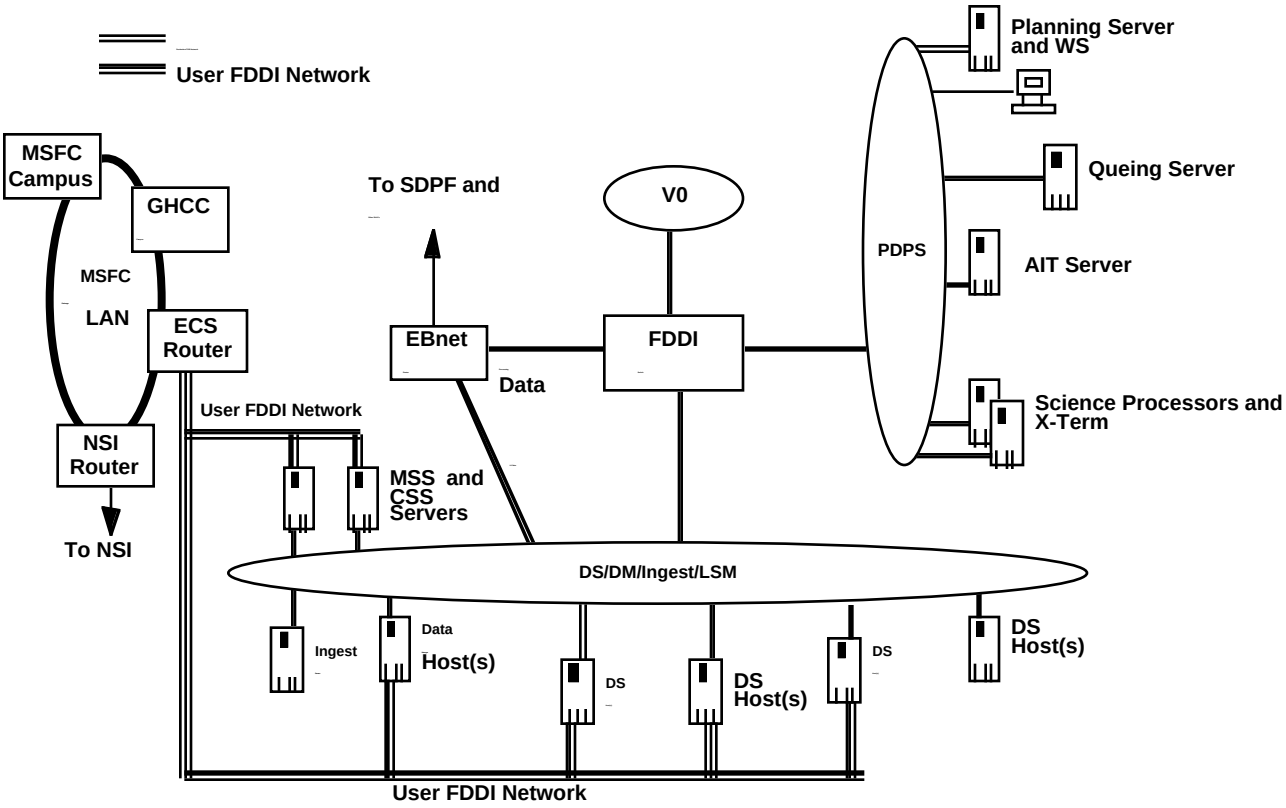


***Figure 3.4.1-1. MSFC DAAC LAN Topology***

The Production Network consists of multiple FDDI rings supporting the DAAC subsystems and connections to external production systems (such as the SDPF and other ECS DAACs) via EBnet. The separation and aggregation of hosts and subsystems onto FDDI rings is driven mostly by RMA and data flow requirements. For instance, EBnet has a direct interface to the Ingest hosts' FDDI ring because of the strict RMA requirement for receipt of Level 0 data (0.998 with MDT of 15 minutes). The DM, LSM, Data Server, and Ingest hosts are contained on a single ring because their flows are expected to be fairly small given that user traffic will be processed on the separate User Network (see discussion below). Another ring provides access to the EBnet router to handle DAAC-DAAC production flows. The FDDI Switch is the central device connecting the FDDI rings together, and it provides the necessary routing and filtering control. Note that device counts in the figure are approximate and (for clarity) workstations and printers are not shown.

The User Network is an FDDI-based LAN connecting users (via NSI, local campuses, general Internet, etc.) to the DAAC hosts responsible for providing user access. It has the main advantage of separating user and production flows. This allows DAAC processing data flows to be unaffected by user demand, so that even unanticipated user pull will not hinder the production network. Basically, the User Network provides access to Data Manager hosts and to a subset of Data Server hosts that interact directly with users. Users will not have access to any other hosts, such as Ingest or Processing devices. The CSS and MSS servers are connected to the User

Network but will not allow direct user access. These connections are required for communications with outside networks for such things as name lookups and receipt of Internet mail, as well as communication with and monitoring of the DAAC's interfaces to the user community (such as NSI and the local campus).

The User Network will connect to the MSFC Exchange LAN through an ECS router which will provide the necessary routing and filtering controls. NSI, the local GHCC campus, and the remote MSFC campus will also be connected to the MSFC Exchange LAN. ECS will connect to V0 through a direct interface on the production FDDI switch. This interface will be used for migration of V0 data; V0 will have a separate connection to EBnet for other V0 flows.

The individual FDDI rings for both the User and Production Networks will be implemented with FDDI concentrators to provide ease of wiring and central points of management. All DAAC hosts will have FDDI interfaces and will be attached directly to the FDDI rings. Workstations will have single-attached FDDI cards, whereas the high-performance servers and processors on the Production Network will have dual-attached FDDI cards to provide redundancy. The interfaces of these machines that are on the User Network will have single-attached interface cards. Dual-attached hosts will be dual-homed to two separate FDDI concentrators to provide an additional level of redundancy in the event of a hub failure. Printers, which will be the only Ethernet devices in the DAAC, will be connected to the DS/DM/Ingest/LSM FDDI ring via an FDDI-to-Ethernet hub.

#### 3.4.1.1 Sizing/Performance Rationale

The data flow estimates used as input to the design process for the MSFC DAAC LAN topology are contained in Table 3.4.1.1-1. The table, based on both dynamic analysis (on the January 1995 AHWGP baseline; results for epoch e (1Q98)) and static analysis (on the August 1995 AHWGP baseline, results for Dec99, and the August 1995 User Pull Baseline, results for greater of July99/Jan00), is arranged according to the source and sink of the flow. It provides both "raw" 24-hour average data flows (including any applicable reprocessing) which are the output of ECS models, as well as weighted flows containing all overhead and contingency factors. The "Factors Applied" column shows which factors (listed beneath the table) were applied to each data flow.

***Table 3.4.1.1-1. Estimated Rel. B Data Flows for the MSFC DAAC***

| Data Flow Description | Raw Volume (in Mbps) | Factors Applied | Weighted Volume (in Mbps) |
|---|---|---|---|
| L0 Ingest to Data Server | << 0.1 | 2,3,4,5,6 | < 0.1 |
| Data Server to Processing | 1.2 | 1,2,3,4,5,6 | 12.2 |
| Data Server to Distribution Server | 1.1 | 1,2,3,4,5,6 | 11.1 |
| Processing to Distribution | 1.0 | 1,2,3,4,5,6 | 10.1 |
| Data Server to/from other DAACs | 6.6 | 1,2,3,4,5,6 | 66.9 |
| User Pull | 1.9 | 2,3,4,5 | 5.2 |

Overhead Factors:

(1) AI&T Factor: 1.2. This factor not applied to Ingest or User flows. Accounts for capacity for integration and test flows.

(2) TCP/IP/FDDI Protocol Overhead: 1.25. Accounts for overhead associated with FDDI, IP, TCP, and other protocols (such as DCE).

(3) FDDI Maximum Circuit Utilization Factor: 1.25. Accounts for amount of 100 Mbps bandwidth that is actually usable for sustained data rates.

(4) Average-to-peak Conversion Factor: 1.5. This provides elasticity in the network by converting the 24 hour averages provided by the model into peaks.

(5) Scheduling Contingency: 1.2. This reflects the ability for the network to "catch-up" within 24 hours from a 4 hour down-time (24/20=1.2).

(6) Operational Hours Factor: 3.0 at MSFC. Accounts for percentage of day/week operations are performed. This factor is applied only to processing flows, not to user flows.

## 3.4.2 MSFC Hardware Configuration

The MSFC hardware configuration for Release B builds on the Release A supplied capacity and is designed explicitly to support EOS/AM-1 mission operations in addition to TRMM mission operations. Sizing estimates for MSFC are based on the ECS CDR Technical Baseline, dated August 1995.

The subsections which follow below provide a synopsis of the design process, and the resultant configuration for the MSFC site for Release B. Figure 3.4.2-1 below, provides an overview of the entire configuration and includes the Release A configuration built upon by the Release B required units (shaded components are added at Release B).

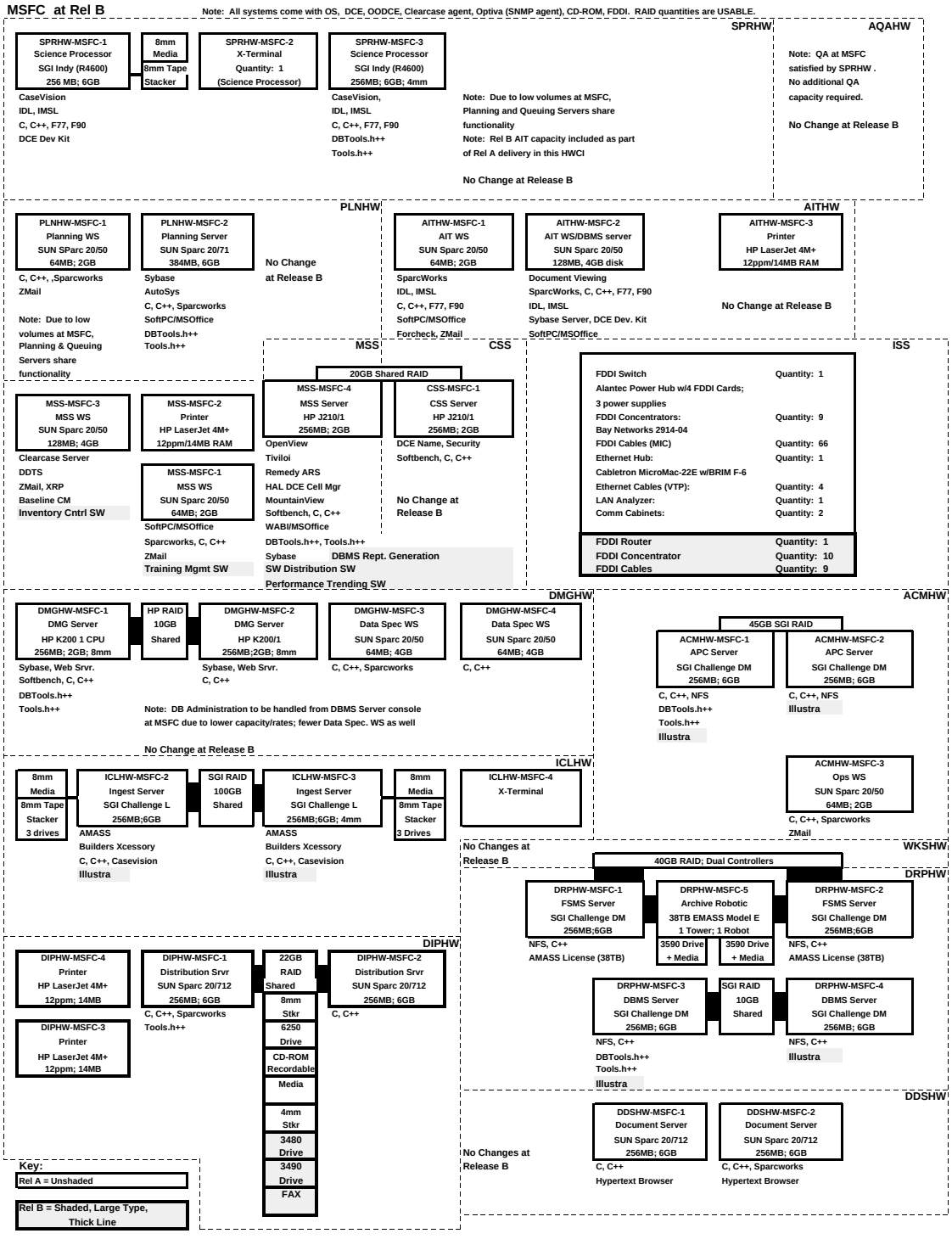


***Figure 3.4.2-1. MSFC DAAC Hardware Configuration Overview Diagram***

### 3.4.2.1 Client Subsystem

There is no dedicated hardware support (HWCI) for the Client Subsystem. The Client software configurations are supported by: (1) non-ECS provided hardware platforms, in the case of Client software utilized by the user community, or (2) ECS provided workstations utilizing Client software in support of operations users (network management, DAAC operations, etc.).

### 3.4.2.2 Data Server Subsystem

During the Release B time frame at the MSFC DAAC, a Data Server configuration is supplied to support the following data storage and access services: TRMM instruments, as described in 8/1995 Technical Baseline, as well as V0 migration data. The configuration discussed in the subsections that follow provide a preliminary design of the configuration and sizing of the Data Server hardware for Release B. The reader should note that the MSFC configuration is basically unchanged since Release A. (The only changes noted is the possible inclusion of 2nd tier working storage, contingent on CDR level design, and an augmentation of distribution peripherals.) Any adjustments and sizing refinements that may be applied to MSFC will be based on project level decisions in the areas of reprocessing, backup, user pull sizing, produce versus store policies, and adjustments to the technical baseline driven by processing modifications by the instrument teams. The reader is encouraged to refer to the Data Server specific volume of DID 305 for more details on the operational and engineering concepts that form the basis for the DSS Release B design and a more detailed discussion of these design variables.

The Data Server Subsystem configuration provides a MSFC configuration supported by four hardware CIs and is sized for the mission support as described above for a period of one calendar year beyond AM1 launch date plus V0 data migration for the same time period:

- *Access Control & Management (ACMHW HWCI)* -- The access hardware allows for client access (both the client subsystem and direct "push/pull" user access) to the Data Server subsystem, provides tools and capabilities for system administration, and is broken down into two components; Administration Stations (AS) which consist typically of operations support workstations, and Access/Process Coordinators (APCs) which consist of server class machines with host attached disk pools.
- *Working Storage (WKSHW HWCI)* -- Working Storage (WS) hardware of the Data Server supplies a pool of storage used for temporary file and buffer storage within the data Server architecture. During the Release A time frame, this consists of disk storage only (no archive tape and robotics). For Release B the addition of a 2nd tier of working storage is being introduced, as originally described in the DSS SDR design. This second tier will store data for a longer period of time than the disk based portions of WS, but all data in WS regardless of storage duration is still considered temporary in nature and not part of the permanent archive.

- *Distribution and Ingest Peripheral Management (DIPHW HWCI)* -- The hardware of the Distribution and Ingest Peripheral Management supports the hard media distribution methods for data dissemination from the system, as well as hard media ingest of data into the system. The hardware provided by this HWCI includes a variety of media and media drives, jukeboxes/stackers as necessary, and server hosts and disk storage for network distribution.
- *Data Repository (DRPHW HWCI)* -- Data Repositories (DRs) are the hardware components that store and maintain data permanently. This consists of DBMS based repositories and archive tape library based repositories. This HWCI provides the disk, server, archive robotics, media and archive tape drives required to support the "permanent" storage repositories.
- *Document Data Server (DDSHW HWCI)* -- This HWCI provides the disk and server required to support the Document Data Server portion of the DSS. Note that the goal for the DSS is to eventually integrate the DDSHW HWCI and associated software seamlessly into the other 4 DSS HWCIs in the Release B time frame. This integration is still under analysis.

#### 3.4.2.2.1 Rationale

The following subsystem-wide assumptions were applied in sizing the Data Server hardware components. Data Server Subsystem is sized for : TRMM instruments, as described in 8/1995 Technical Baseline, as well as V0 migration data support for a period of one calendar year beyond AM1 launch date. Dynamic modeling was used to size the permanent data repository components, such as the number of robotic arms, tape drives, and production related staging disk. The ECS technical baseline for 8/95 was used both in dynamic modeling as well as in static analysis. User modeling data was used in estimating the user access rates to the system where appropriate, however DSS sizing is still being driven by the ECS Project direction to size for a distribution volume two times the site's total DSS ingest volume. Table 3.4.2.2-1 summarizes the dynamic modeling result for the Release B Data Server components. The table parameters are as follows: Blocking Buffer and DH (Data Handler) disk together constitute the production related disk allocation in the Working Storage disk formula, Archive Station is equivalent to an archive tape drive, Archive Robot is self explanatory. (Note: These numbers represent minimum requirements for functionality and performance. No RMA considerations are included in these numbers.)

***Table 3.4.2.2- 1 Synopsis of Relevant Dynamic Modeling Parameters(Epoch K)***

| Site | Blocking Buffer Usage, max (GB) | DH Disk Usage, max (GB) | Archive Robot Usage, avg | Archive Station Usage |
|---|---|---|---|---|
| MSFC | 2.99 | 9.68 | 1 | 2 |

*ACMHW* Analysis was undertaken primarily for the sizing of the APC server hosts and their attached disk storage. The administration workstations are assumed to continue to be minimally configured workstations designed to perform various operations functions (e.g. DBMS administration, repository administration, etc.). Client desktop services as well as X protocol access to Data Server hosts is the driving sizing factor.

The APC server provides the session establishment point for the client, routes service requests to the other CSCIs and HWCIs, and functions as the electronic distribution channel for the DSS user pull and push loads. APC server host runs the following software processes and applications: ScienceDataServer Process, ScienceDataServer Administration Process, SubscriptionServer Process, Network ResourceManager Process, PullMonitor Process, CSS DCE client, CSS logging API, and an MSS agent. The anticipated internal I/O to be sustained by the processor averaged over 8 hours of operation is calculated as follows:

I/O = [Distribution of 18.34 GB *(MSFC daily Data Server intake)* / 86,400 *(sec in 24 hrs.) + 20% for ingest + 5% control traffic] *2 (read/write worst-case).54 MB/sec nominal load*

The Release A Challenge series supplied to MSFC total I/O bandwidth is 320 MB/sec, which is adequate for the projected requirements and allows for growth in the subsequent Releases.

*APC Host Disk* -- The APC server host disk is sized for electronic ingest (almost exclusively from sources external to the DAAC), as well as electronic distribution (again, almost exclusively to the recipients external to the DAAC) since this pool of hosts is designed to manage the requests to the Data Server as well as the service response. For Release B, the electronic distribution, as defined within the ECS Technical Baseline for IDR, is "one times" of the total Data Server ingested volume. This "one times" volume is made up of data that is "pushed" and "pulled" by the user. The distribution of this electronic data is assumed to occur over a 24-hour period. It is further assumed that on the average each granule placed on the distribution volumes are pulled/pushed twice to two separate users. (This assumption is based on the workings of subscriptions, (assuming that a granule that is subscribed to more than once), and the fact that interesting data will be requested more than once when inserted while some data may not be requested at all.) 48 hours accumulation capacity of 18.34 GB/day at MSFC plus 20% for potential electronic ingest is sized. The total allocated disk capacity is therefore 45 GB.

*WKSHW* The formula for the total capacity of Working storage disk (adapted to the FSMS host) is sized to deal with the following three categories of staging requirements, which are in turn summed together to provide the site sizing:

- *Production Staging* -- consists of the following items summed together

  (Modeling Estimate for Maximum Blocking Buffer Requirement )

  + (Modeling Estimate for Maximum Data Handler Disk Usage )

  + (*10%* * (Modeling Estimate for Maximum Data Handler Disk Usage) for failed products )

- In support of Electronic Distribution Staging (transfers to the APC Host's access disk):

  (disk space for 1 largest granule requested for distribution from the AHWGP data (2.5 GB) times 4 users {from User Modeling analysis for PDR} (latency of 1/2 hour))

- In support of Electronic Ingest: (transfers from Ingest into the Data Server):

  (disk space for one largest granule requested for distribution (2.5 GB))

- In support of Hard Media Distribution/Ingest: (transfers to/from Hard Media Distribution/Ingest into the Data Server):

  (disk space for one largest granule requested for distribution (2.5 GB))

Thus, for the MSFC configuration, the Working Storage estimate is calculated as follows...

*[Production (2.99) + (9.68) + [Failed Products (0.1*9.68)]] + [Electrinic Ingest/Distribution (3.6*4) + (3.6)] + [Hard Media Ingest/Distribution (3.6)]= 35.2 GB = 40 GB*

*DIPHW* The DIPHW configuration at MSFC includes primarily server host and disk units to serve media based distribution production temporary staging (as well as for some types of Ingest as well), and includes a number of peripheral form factors.

*Temporary Staging Server Support* -- This server is designed to support the media distribution load (as well as a small factor for ingest loads). That is it is designed to handle the I/0 for 1x (one times) distribution of the Data Server ingested volume per twenty-four hours of operation, servicing this load in a nominal 8 hr. total shift period. The platform is sized to handle the network transfer traffic to local disk from the FSMS Server Host source, as well as the media preparation and media ingest I/O. The software processes/applications mapped to this server are: DistributionServer process, ResourceManager Processes for CDROM, various tape, and printers, CSS DCE client, CSS logging API, and an MSS agent. Two server hosts are provided in order to comply with RMA requirements for the function of archiving and distributing data with the required availability of 0.98 and the mean down time not to exceed 2 hours. The hosts are cross-strapped with access to a common pool of staging storage (discussed below). The nominal I/O load to be supported by this platform is calculated as follows for MSFC:

*I/O = [*18.34 *GB (MSFC daily ingest) / 28800 (sec in 8 hrs.) + 10% for ingest ] * 2 (read/write)*

*= 1.43 MB/sec nominal load*

The disk associated with the hard media distribution platform is sized for hard media distribution of *1x* (one times) of the total Data Server ingested volume per 8 hour operations. The same assumption is used here as was used in the APC disk sizing, namely that on the average each granule placed on the distribution volumes are written twice to two separate users. 8 hours accumulation capacity, plus ten percent, for potential hard media ingest is sized. The ingest activity is assumed to be negligible, since the Ingest Subsystem is sized to handle the high volume electronic ingest loads. The DIPHW disk is sized at 22 GB.

*Peripheral Support* -- The peripherals supported at the MSFC site for Release B were selected based on Level Four requirements: S-DSS-30440, S-DSS-30470, S-DSS-30480 (reference SDPS Requirements Specification for the ECS Project, 304-CD-002-001). We have retained the single Release A 6250 Tape drive. In the case of 6250, V0 operational experience has shown that its use as a heritage device is low enough to make the provision of a spare drive unnecessary. In the event of the drive failure the low workload will allow waiting for the drive repair or replacement without a noticeable impact on operations. The HWCI complement may be easily scaled for both media types as well as capacity. The peripherals supplied here are included in the configuration to primarily support distribution functions. However, the Ingest Subsystem (Ingest Client) residing at MSFC may utilize peripherals to perform some media based ingest, as necessary, based on media form received for storage. This applies only to peripherals not already configured into the Ingest complement for performance reasons.

The types of media form factors/formats selected for Release B include:

- 8mm Tape,
- 6250 Tape (heritage),
- CD-ROM,
- 3480/3490,
- 4 mm Tape,
- FAX.

The aggregate bandwidth of many reasonable mixes of peripheral devices exceeds the estimated required bandwidth of media based data distribution and ingest in Release B: MSFC - 1.43 MB/sec (For reference, the throughput rate of a representative 8 mm drive in an uncompressed mode is 3 MB/sec.) The proposed relative mix of Release B identified peripherals will be based on User Modeling, DAAC surveys, and the ongoing analysis of the AHWGC inputs. A full analysis of peripheral mixes will be provided by CDR-B.

It is also worthy to note that this HWCI provides the network laser printers for the DAAC DS operations.

*DRPHW* The DRPHW configuration at MSFC includes both archive based as well as DBMS based physical repositories. They are sized as follows:

*Archive Repository* -- The archive component was sized through a combination of both static analysis as well as dynamic simulation. The model employed was the dynamic system model, based on a discrete event simulation with constrained resources assumed. Modeling runs based on the August 1995 Technical Baseline were performed. Nominal and peak resource utilization data was used from the model runs and gave specific data regarding disk, tape drive and robotic resource utilization. This data was used in a static sizing analysis synopsized here for MSFC that was coupled with the key driving requirements with respect to distribution (e.g. the x2 distribution cap, the User Model service access predictions for epoch k), flow analysis, and data with respect to hardware and software COTS selections.

AMASS was chosen for the Release A archive FSMS and is currently the candidate product for Release B. Enhancements to the product deemed necessary for Release B functionally and performance requirements (i.e., BER monitoring, better cache management, Release B archive drive support, etc.) are currently being negotiated with the vendor. Final choice for the FSMS product will be contingent on these negotiations, Release A experience, and prototyping with other competing products. For the FSMS Manager host server, the platform is selected on the basis of FSMS(AMASS)/platform COTS S/W compatibility. Memory and cache estimates are currently based on vendor recommendations, reference "AMASS Archival Management and Storage System, Installation on Silicon Graphics", EMASS Part Number 600149, AMASS Version 4.2.4, March 1995. Aside from the AMASS FSMS the following processes and applications will run on this server: ResourceManager Process for the staging disk, StagedDataMonitor Process, CSS DCE client, CSS logging API, and an MSS agent. Two server machines (for RMA failover capability) will share access to the Working Storage disk pool.

For the Archive Tape Library Robotics an EMASS Automated Management Library system (Quadro Tower) was selected for Release A based on its ability to accommodate multiple media form factors, storage density, growth capacity, floor space utilization, compatibility with COTS software and a number of other factors. (This selection process is documented in the SDPS Storage Technology Insertion Plan white paper (June 1995, #420-WP-003-001) and is not fully discussed here). Release B will baseline the use of these robotics at the IDR-B time frame. For most of the larger DAACs, we are assuming the performance signature of STK D3 drives in the robotic unit. For MSFC, our preliminary design is to leave 3590 technology in place for now. BER monitoring and archive maintenance are still factors that need to be worked out by CDR-B. The dynamic model analysis resulted in a utilization factor for sizing estimation purposes as given below:

*MSFC: Configuration: 1 unit Calculated Robotics Utilization: 1 Robotic Arms*

*Calculated Tape Drive Resource Utilization: Less than 1 unit, therefore 2 units provided*

The Release A MSFC configuration assumed the use of 3590 (NTP) technology, yielding a total robotic storage density of approximately 57 TBs. The Release A MSFC required volume was 6.2 TBs, with approximately 8.1 TBs of 3590 media specified for delivery. Media requirements were calculated based on the one year Release A operations at MSFC, and media to support Release A V0 migration, as well as Release A V0 and ECS data holdings. In Release B the accumulated MSFC data volume is projected to be approximately 15 TBs. Therefore the figures discussed here relate primarily to media piece-count configurations for MSFC ECS V1 operations, and are not limiting factors with respect to the tape library configuration itself.

The volume calculations are based on the Technical Baseline of 8/95 for the Release B product data volumes and for the identified V0 migration. It is assumed that the product data cumulates over the 9/97 through 6/99 time period. The Release B volume of 15 TBs equates to approximately 1500 10 GB 3590 cartridges. No compression is assumed. Backup capacity of 20% and a spare tape capacity of 10% are added. The total calculated media support requirement for Release B and V0 operations is as follows:

*(Release B ECS= 15000 GB) + 20% backup capacity + 10% spare media capacity*

*= 19,800 GB --> 1980 count of D3 tapes required.*

DBMS Repository -- The Data Base Management System (DBMS) Repository component was sized as follows based on static data size analysis as well as transaction based analysis. The transaction analysis is based on both "push" (production metadata update) and "pull" (user access and distribution) loads. Transaction rate was modeled based on the user service request rates as described at PDR time in the User Pull Analysis Notebook, 160-TP-004-001, Question 47 and a cross section of query types derived from the DBMS Benchmark Report, 430-TP-003-001.

The DBMS Server Host was sized based on based on the transaction analysis mentioned above, as well as platform suitability analysis based on the DBMS COTS software selection for Release B Data Servers (Illustra). Platform suitability is based on the DBMS software manufacturer's compatibility recommendations, benchmark data, and project bench marking activities. Aside from the Data Base engine, the following processes will run on this host: CSS DCE client, CSS logging API, and an MSS agent.

DBMS Server Disk was sized based on the core metadata associated with TRMM and the V0 data sets identified for migration within Release B. The size of the metadata granule for V0 was assumed to be half (0.91 KB) that of the full ECS metadata granule of 1.82 KB. That assumption is based on the 50% mapping of V0 attributes to ECS core attributes across all products throughout the Release A duration.

The key assumptions associated with the DBMS repository sizing are as follows:

- The products lists have been derived from the DAAC instrument teams representatives and the ECS Technical Baseline.
- The period of data capture is 9/1/1997 through 6/1/1999.
- All products are assumed to conform to the Proposed ECS Core Metadata Standard v2.0, 420-TP-001-005, Dec. 1994.
- The metadata sizing has been calculated from the Metadata Expected with each granule table on Page 94 in the Proposed ECS Core Metadata Standard v2.0, 420-TP-001-005, Dec. 1994.
  - The calculated size of 1.823 KB per granule has been obtained from this data source.
- An overhead factor of 2.4 for implementation in Illustra has been estimated based on the benchmarking activities as outlined in the DBMS Benchmark Report, 430-TP-003-001.
- An estimated overhead of 80MB will be made for the Illustra product code. Note that this includes sizing for the Illustra database product, the 2-D Spatial Data Blade, and the 3-D Spatial Data Blade.
- All instruments on TRMM are considered to exist in the Data Server as a continuation of Release A.

The calculated disk capacity for the MSFC repository (static analysis) results in a computed requirement of .4 GB. Due to the operational experience with the user space requirements, at least 5 GB of disk space must be allocated for a high use data base functioning. Therefore, at least 5 GB beyond the calculated storage requirement will be allocated - 5.4 GB. (The closest available quantity of disk equal or exceeding 5.4 GB will be purchased.) Dual host configuration will allow for failover.

DOCUMENT DATA SERVER Document handling is handled via a dedicated Data Server implementation, geared to the predicted document ingest and access volumes and the nature of the COTS S/W requirements imposed on the support hardware. The Document Data Server is provided as a simple server configuration with network access. The following assumptions were made in the preparation of the MSFC Document Data Server configuration:

1. Metadata alone has been considered as a basis for the sizing calculations.
2. GSFC figures for the Guide Document sizes have been used.
3. MSFC figures for the algorithm documentation sizes have been used.
4. The period for Release-B products on the TRMM mission is 9/1/97 to 6/1/99.
5. The figures are approximations, which will be refined over time. The Document Data Server architecture is scalable.
6. The Document Data Server continues to exist as a separate server. As the design effort for Release B continues relative to the Sybase/Illustra selection, the Document Data Server could be collapsed into the DBMS Server. This would change the document storage sizing and cause it to be added into the DBMS Server sizing.

A 2 CPU SMP server was selected based upon operational experience with the EDF EDHS. A WAIS-like, full text indexer, an http server, and additional custom developed software will reside on this host. The following processes/applications run on this host: Document Data Server Process, WWW Server Process, Document Repository Process, Client Applications Process, CSS DCE client, CSS logging API, and an MSS agent.

The disk complement was sized to hold the document metadata for the data product collections associated with the TRMM mission and for the V0 data sets identified for migration. Sizing for document metadata was based on available V0 guide document sizing, and the 2.0 Core metadata baseline. Growth was based on the phased migration of V0 data sets and the TRMM data product collections acquired during Release B operations. The calculated required disk capacity for the document collection alone is 400 MB.

#### 3.4.2.2.2 Configuration

The specific sizing for the Release A MSFC Data Servers, derived from the rationale described above, is synopsized below.

For the MSFC Science Data Server....

***ACMHW***

- Admin. Workstations: 2 ea. of SUN Sparc 20/50
- APC Hosts: two 1 CPU SGI Challenge, configured with 45 GB, minimum, of RAID Disk.

***WKSHW***

- 40 GB, minimum, of RAID Disk.

***DIPHW***

- Staging Server Host: two SUN Sparc 20/712, with access to 22 GB disk.
- Standard Release A Peripheral Set: 8mm Tape drives and stackers, 4mm Tape drives and stackers, 6250 Drive, CD-ROM drive and jukebox, FAX, 3480/3490 outboard drives.

***DRPHW***

- FSMS Server Host: two 1 CPU SGI Challenge, which utilizes WKSHW for primary disk
- Archive Tape Library Robotics: 1 AMASS AML Model 2 Tall Quadro Tower system, single robotic
- Tape Drives: 2 3590 (NTP) drives
- Tape Media: 1980 of 3590 tapes, each at 10 GB capacity (including 20% backup capacity and 10% spare tape capacity)
- DBMS Server: two of 2 CPU SGI Challenge XL, with 10 GB of shared disk

For the MSFC Document Data Server....

- WAIS/http Data Server 2 of 2 CPU SMP Server
- Document Server Disk: 6 GB mirrored in two machines for Release-B

#### 3.4.2.3 Data Management Subsystem

The Data Management Subsystem (DMS) consists of a single Hardware CI (HWCI) that will also support the processing requirements of the Interoperability Subsystem (IOS) in Release B at the MSFC DAAC site.

The DMS is responsible for Advertising Service CI, Data Dictionary CI, Gateway CI, Local Information Manger CI and Distributed Information Manager CI processing activities generated directly from user "pull" search invocations. The DMGHW CI consists of four major components: 1) DBMS/Web Processing Server, 2) Database Management Workstation, 3) Data Specialists Workstations, 4) User Support Workstations.

The DBMS/Web server is the primary hardware component in the Data Management Subsystem. The server provides DBMS storage, input/output (I/O), and processing resources in support of

the Advertising Service CI, Data Dictionary CI, Gateway CI, Local Information Manager CI and Distributed Information Manager CI in Release B.

The DMGHW CI configuration provided in Section 3.4.2.3.2 depicts the migration of the Release A hardware design to the Release B candidate hardware design. The Release B candidate hardware design accommodates Release B platform design issues concerning scalability and evolvability. The candidate hardware design is tailored to Release B MSFC DAAC specific processing needs in support of Advertising Service CI, Data Dictionary CI, Gateway CI, Local Information Manger CI and Distributed Information Manager CI processing functions. The Release B MSFC DMGHW CI is designed to support TRMM LIS mission datasets. Section 3.4.2.3.1, below, provides the rationale behind the recommended hardware configuration and is subject to change as Data Management software CI (under investigation in the incremental development track) prototyping results become available.

#### 3.4.2.3.1 Rationale

The performance impact on the DMGHW CI DBMS/Web server in Release A has been determined to be negligible. In order to avoid unnecessary swap-outs of hardware after Release A, the DMGHW CI has been sized according to Release B processing predictions; therefore, the DMGHW CI Release B design builds on the Release A design without the need for large scale changes. The performance drivers for sizing the DMGHW CI server for Release B are:

- User Characterization analysis of science and non-science user search invocations
- DBMS/CI transaction rate (performance) analysis
- DBMS/CI prototype/benchmark analysis
- Hardware Scalability and Evolvability Analysis

***User Characterization Analysis:*** User Characterization data provides the projected number of science users, number of non-science users, frequency of search service invocations per time period, and the percentage of invocations for each search service in the Release B time frame. In Release B, the primary users that will access the Data Management databases (Gateway CI, Data Dictionary CI, Local Information Manager CI, Distributed Information Manager CI) are projected to be part of the science community, and the primary users that will access the Interoperability database (Advertising Service CI) are projected to be part of the non-science community.
Tables 3.4.2.3-1 and 3.4.2.3-2 summarize Science User search invocation percentages for search type and frequency of search invocations per hour, as documented by the User Characterization Team.

***Table 3.4.2.3-1. MSFC User Characterization Science User Search Types (EPOCH M)***

| Search Type | Fraction of total invocations/year |
|---|---|
| Simple Search/1 site | 0.29 |
| Simple Search/multi-site | 0.18 |
| Match-up Search/1 site | 0.33 |
| Match-up Search/multi-site | 0.19 |
| Coincident Search/1 site | 0.00101 |
| Coincident Search/multi-site | .000076 |

***Table 3.4.2.3-2. MSFC User Characterization Searches per hour for Science Users (EPOCH M)***

| DAAC | Searches per hour (busiest time of day) |
|---|---|
| MSFC | 9 |

Tables 3.4.2.3-3 and 3.4.2.3-4 summarize Non-Science user accesses per day and percentage of search invocations, as documented by the User Characterization Team.

***Table 3.4.2.3-3. MSFC User Characterization User Accesses per Day for Non-Science Users (EPOCH M)***

| DAAC | User Accesses per Day |
|---|---|
| MSFC | 2152 |

***Table 3.4.2.3-4. MSFC User Characterization Non-Science User Search Types (EPOCH M)***

| Search Type | Percentage of Total Searches |
|---|---|
| Simple Search/1 site | 60% |
| Match-up Search/1 site | 15% |
| Coincident Search/1 site | 25% |

***DBMS Transaction Rate Analysis:*** In order to size the DBMS server it is necessary to estimate the size of the Interoperability (Advertising Service CI) and Data Management (Gateway CI, DDICT CI, LIMGR CI, DIMGR CI) databases and then determine the transaction rates, or database throughput that must be provided in support of the "pull" search activities that will be invoked by the user community. The transaction rate analysis is based on assumptions regarding the amount of processing associated with the six different types of search services that pertain to

the Interoperability and Data Management software CI's. Release B transaction assumptions were made to define transaction loadings per search request. Number and type of search requests are provided by the User Characterization Team. Depicted transaction loadings are assumptions that are based on search complexity. The loadings will be refined with actual performance benchmarks as future prototypes are completed. The observed loading from future prototyping/benchmarking activities will be compared to the predicted ones (documented below) and the sizing analysis will be updated as a result (these transaction loading assumptions are defined as "nominal" cases). The transaction data provided is projected for the Release B time-frame.

The projected frequency and percentage of science user search invocations are documented in the User Characterization Analysis section above. Searches/hour are calculated for the busiest time of day. The processing (transactions per service invocation) assumptions are based on Advertising Service CI and Gateway CI database preliminary transaction analysis results and will be revised based on future prototyping/benchmarking analysis results as they become available. Table 3.4.2.3-5 lists the predicted transaction loading associated with the Advertising Service CI and Gateway CI databases based on frequency of science user search invocations.

***Table 3.4.2.3-5. MSFC Science User Transaction Loading for Advertising Service CI and Gateway CI Databases (EPOCH M)***

| Search Type | Percentage Invoked | Searches/hour | Processing Assumptions (Transactions per Service Type) | Transactions /hour |
|---|---|---|---|---|
| Simple Search/1 Site | 29% | 3 | 5 | 15 |
| Simple Search/Multi-Site | 18% | 2 | 20 | 40 |
| Match-up Search/1 Site | 33% | 3 | 5 | 15 |
| Match-up Search/Multi-Site | 19% | 2 | 20 | 40 |
| Coincident Search/1 Site | .101% | .01 | 5 | .05 |
| Coincident Search/Multi-Site | .0076% | .001 | 20 | .02 |

Table 3.4.2.3-6 lists the transaction loadings for the Gateway CI database based on non-science user search invocations as depicted in "User Characterization and Requirements Analysis" (19400312TPW). Table 3.4.2.3-6 is completed with the assumption that there will be at least five search invocations per access on average.

***Table 3.4.2.3-6. MSFC Non-Science User Transaction Loading for Gateway CI Database (EPOCH M)***

| Search Type | Percentage Invoked | Searches/hour | Processing Assumptions (Transactions per Service Type) | Transactions /hour |
|---|---|---|---|---|
| Simple Search/1 Site | 29% | 18 | 5 | 90 |
| Simple Search/Multi-Site | 18% | 11 | 20 | 220 |
| Match-up Search/1 Site | 33% | 21 | 5 | 105 |
| Match-up Search/Multi-Site | 19% | 12 | 20 | 240 |
| Coincident Search/1 Site | .101% | .06 | 5 | .3 |
| Coincident Search/Multi-Site | .0076% | .005 | 20 | .1 |

The estimated total non-science user accesses per day for the Advertising Service CI is calculated to be 2152 as depicted in "User Characterization and Requirements Analysis" (19400312TPW). The percentage that each search type, pertaining to the Advertising Service CI DBMS, is invoked is also taken from "User Characterization and Requirements Analysis" (19400312TPW). Table 3.4.2.3-7 is completed with the assumption that there will be at least five search invocations per access on average, and that each search invocation produces five transactions for the processor/DBMS. Search invocation transaction rates will be revised based on future prototyping/benchmarking analysis results as they become available.

***Table 3.4.2.3-7. MSFC Non-Science User Transaction Loading for Advertising Service CI Database (EPOCH M)***

| Search Type | Percentage Invoked | Searches/hour | Processing Assumptions (Transactions per Search Type) | Transactions /hour |
|---|---|---|---|---|
| Simple Search/1 Site | 60% | 231 | 5 | 1155 |
| Match-up Search/1 Site | 15% | 58 | 5 | 290 |
| Coincident Search/1 Site | 25% | 96 | 5 | 480 |

Preliminary transaction loading results for Interoperability and Data Management CI processes are depicted in Table 3.4.2.3-8. At this time the Data Dictionary CI transaction loading is equated to the transaction loading of the Advertising Service CI since the type and frequency of transactions are predicted to be very similar. Due to the fact that DIMGR and LIMGR CI processes are perceived as being the most expensive (in terms of cost to the CPU), and that prototypes will not be developed until after Release B IDR, preliminary sizing estimates have

been achieved by doubling the transaction load of the Gateway CI and applying the result to LIMGR CI and DIMGR CI processes. Although equating Advertising Service CI and Data Dictionary CI processes, and doubling the Gateway CI transaction load to produce LIMGR CI and DIMGR CI transaction loadings does not pin-point the performance cost that will be levied on the DMGHW CI, it does provide a preliminary glimpse at expected CPU activity in the absence of real-time prototyping/benchmarking results. The preliminary transaction results for the Advertising Service CI, Gateway CI, Data Dictionary CI, LIMGR CI and DIMGR CI will be revised based on future prototyping/benchmarking analysis results as the Incremental Track software design matures in the future.

Table 3.4.2.3-8 summarizes science, and non-science user transaction loadings per hour for the Advertising Service CI , Gateway CI, Data Dictionary CI, LIMGR CI and DIMGR CI databases.

***Table 3.4.2.3-8. DBMS Transaction Summary (EPOCH M)***

| DAAC | User Type | DBMS | Searches/hour | Transactions /hour | TPM |
|---|---|---|---|---|---|
| MSFC | Science | Gateway/Advertising | 10 | 110 | 2 |
| MSFC | Non-Science | Gateway | 62 | 655 | 11 |
| MSFC | Non-Science | Advertising | 385 | 1925 | 32 |
| MSFC | Non-Science | Data Dictionary | 385 | 1925 | 32 |
| MSFC | Science | LIMGR | 144 | 1530 | 25 |
| MSFC | Science | DIMGR | 144 | 1530 | 25 |
| | | | | | |
| Totals: | | | 1130 | 7675 | 127 |

A sensitivity analysis has been performed with larger loading allocations. The results are depicted in Table 3.4.2.3-9. As a rule vendor supplied Transaction Per Second/Minute (TPS/TPM) ratings tend to be a maximum, or high-end value and do not take into account processing overhead associated with other system processes. Processes that will run on the DMGHW CI in Release B include DCE client, MSS agent, HTPD server, WAIS server, Sybase Server, Sybase Replication Server, Operating System Services, Advertising Service Server, Gateway Server, Data Dictionary Server, LIMGR Server and DIMGR Server.

***Table 3.4.2.3-9. DBMS Transaction Sensitivity Analysis Results (EPOCH M)***

| DAAC | User Type | DBMS | Searches/hour | Transactions /hour | TPM |
|---|---|---|---|---|---|
| MSFC | Science | Gateway/Advertising | 20 | 440 | 7 |
| MSFC | Non-Science | Gateway | 124 | 2621 | 44 |
| MSFC | Non-Science | Advertising | 770 | 7700 | 128 |
| MSFC | Non-Science | Data Dictionary | 770 | 7700 | 128 |
| MSFC | Science | LIMGR | 288 | 6122 | 102 |
| MSFC | Science | DIMGR | 288 | 6122 | 102 |
| | | | | | |
| Totals: | | | 2260 | 30705 | 511 |

Future Incremental Track Development prototyping/benchmarking activities will provide a more detailed performance analysis of Advertising Service CI, Gateway CI, Data Dictionary CI, Local Information Manager CI and Distributed Information Manager CI processes and performance analysis transaction loadings will be revised accordingly.

***DBMS Prototyping/Benchmarking Analysis:*** Currently, preliminary Incremental Track Development performance data is being used to size the processing capacity of the DMGHW CI DBMS/Web server. Performance analysis results will be revised as planned prototyping/benchmarking activities are completed. Future, major prototyping activities that will affect performance estimates for the DMGHW CI include, but are not limited to: 1) Gateway CI prototype, 2) EP6 prototype, 3) Prototype workshop 2, 4) EP7 prototype, 5) EP8 prototype.

DBMS performance estimates provided in "DBMS Benchmark Report" technical paper (430-TP-003-001), show that for multi-user (32 users) queries (20 similar queries accessing different parts of the test database) running concurrently, the test-bed CPU, a SUN SPARCstation 20/50, became saturated. A performance comparison of the DBMS benchmark test-bed processor (SUN SPARC 20/50) and the candidate processor (HP K200) for Release B operations is shown in Table 3.4.2.3-10.

***Table 3.4.2.3-10. Vendor Platform Performance Estimates***

| Platform | TPS | MIPS |
|---|---|---|
| SUN SPARCstation 20/50 (SMP) with 1 processor | 135 | 133 |
| HP K200 (SMP) with 1 processor (PA 7200 CPU) | 240 | 146 |

***Disk Capacity Sizing:*** Disk storage for the DMGHW CI has been determined for each DAAC site based on preliminary Interoperability and Data Management CI DBMS application sizing estimates and vendor inputs for the following COTS software: 1) DBMS software, 2) Development software, 3) HTTP & WAIS server software, 4) Operating System software, 5)

Communications and Utilities software. Capacity sizing for the Interoperability and Data Management databases was achieved by multiplying the expected byte size for core and collection specific attribute definitions by the total number of core and collection specific attributes. Temporary workspace has also been allocated for Interoperability CI and Data Management CI Databases dependent on frequency and variation of queries. For example, DIMGR has a larger capacity requirement since it handles a greater number, and more varied types of queries; therefore, requires more temporary workspace. The expected capacity of Interoperability CI, Data Management CI, COTS, Operating System and Communications and Utilities software to be installed on the DMGHW CI at the Release B MSFC DAAC site is depicted in Table 3.4.2.3-11.

Table 3.4.2.3-11 is filled with preliminary disk sizing results for Release B Interoperability and Data Management software CIs, operational databases and COTS software packages that will be installed on the DMGHW CI at the MSFC DAAC site. Some of the results are estimates (such as database sizes) since the DBMS design will mature and impact disk capacity sizing as the Advertising Service CI, Gateway CI, Data Dictionary CI, Local Information Manager CI, and Distributed Information Manager CI under-go future evaluation and prototyping.

***Table 3.4.2.3-11. DMGHW CI Disk Capacity Requirements (1 0f 2)***

| S/W Component | Release B Capacity |
|---|---|
| **COTS Software:** | |
| Sybase System | 300 MB |
| HTTP Server | 5 MB |
| WAIS Server | 10 MB |
| | **Total: 315 MB** |
| **Databases:** | |
| Sybase Master Database | 3 MB |
| Sybase Tempdb Database | 50 MB |
| Sybase Model Database | 2 MB |
| Advertising Database | 150 MB (Estimate) |
| Advertising DB Workspace | 150 MB (Estimate) |
| Advertising DB Logging | 100 MB (Estimate) |
| Advertising HTML Files | 100 MB (Estimate) |
| WAIS Database | 150 MB (Estimate) |
| Gateway Database | 150 MB (Estimate) |
| Data Dictionary Database | 150 MB (Estimate) |
| LIMGR Database | 200 MB (Estimate) |
| DIMGR Database | 400 MB (Estimate) |
| | **Total: 1605 MB** |

***Table 3.4.2.3-11. DMGHW CI Disk Capacity Requirements(2 0f 2)***

| S/W Component | Release B Capacity |
|---|---|
| **Operating System & Utilities:** | |
| Operating System Software | 700 MB |
| Utilities | 200 MB (Estimate) |
| DCE Client | 46 MB |
| | **Total: 946 MB** |
| | **Total: 2.866 GB** |

### 3.4.2.3.2 Configuration

The selected DMGHW CI DBMS/Web server to be implemented in Release B is a low-end SMP server. At this time a single CPU (per server host) configuration has been determined to be appropriate for the Release B MSFC DAAC; however, two processors (per server host) will be installed at sites where heavier processing loads are expected (based on future Incremental Track Software Prototyping/Benchmarking activities). The benefits of a second processor are processing redundancy, since the server can be set-up to automatically reconfigure itself in a single CPU configuration if one of the CPU's fails, and load balancing. The Release B candidate DBMS/Web SMP server is scalable from one to four processors.

Two physical DBMS/Web servers will be implemented at the Release B MSFC DAAC site. In Release A the configuration called for a primary, or "active" server and secondary, or "standby" server. For Release B, the configuration will be changed to an "active", "active" cluster host configuration. The active/active host configuration will allow for applications to be run in parallel across processors residing in both clustered hosts, which enhances load balancing and availability/recovery capabilities. RAID disk will be implemented such that an operational and mirrored set of the DBMS/Web disk devices will be available to both clustered hosts. In the event of failure to one of the clustered hosts the RAID disk will still be available to the other clustered host. The RAID disk configuration will also be implemented such that a failure to a single operational disk will be recoverable via a "hot swap" disk capability. There will be a total of 10 disks in the RAID unit, five operational and five mirror disks. Each disk contained in the RAID unit will have a capacity of 2.1GB.

Since the Release B processing requirements for the Local Information Manager CI and Distributed Information Manager CI are largely unknown at this time, the flexibility of the recommended hardware design assures minimum risk. The design allows for 100% growth in both processing and storage capacity in support of the Advertising Service, Gateway, Data Dictionary, Local Information Manager and Distributed Information Manager CI's in Release B.

The following configuration diagram, Figure 3.4.2.3-1, *DMGHW CI RAID Disk Configuration* depicts the recommended clustered host / RAID disk configuration:

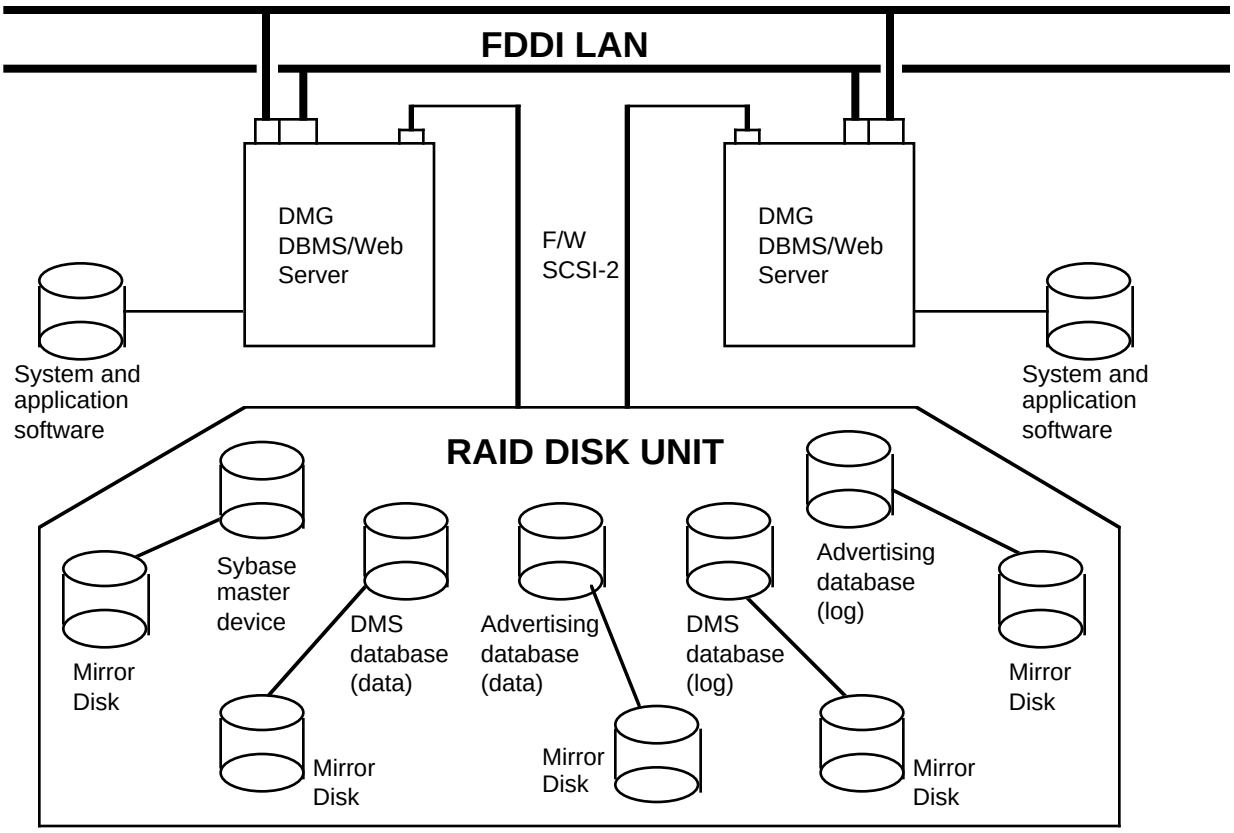


***Figure 3.4.2.3-1 DMGHW CI RAID Disk Configuration***

The DMGHW CI DBMS/Web servers will provide an operational storage capacity of 12.6 gigabytes of local disk drive storage for Release B, and an additional 10.5 GB of mirrored RAID disk. Although the estimates for Advertising Service and Data Management operational databases, COTS software, and operating system and utilities sizing are relatively small, the total disk volume has been increased in support of Sybase swap (workspace) area, 100% growth capacity for the base operational software, and mirrored RAID disk storage. The Data Management databases will be replicated (using Sybase replication server) at each DAAC site. The Interoperability and Data Management software CI's have been distributed over multiple disk drives contained in the RAID disk unit in order to enhance performance (vendor and developer recommended).

A single 8mm tape drive unit will be configured on both active and standby servers in Release A and will remain the same (one per server host) for Release B. The 8mm tape drives will be used to backup Advertising Service and Data Management databases, as well as perform DBA and routine maintenance operations.

A small pool of low-end uniprocessor workstations will support Data Specialist/User Support operations. At a minimum the Data Specialist/User Support workstations will be configured with four gigabytes of local disk each. Note that the uniprocessor workstation configuration will remain the same as in Release A with no need for modification.

Table 3.4.2.3-12 summarizes the recommended DMGHW CI processing configuration for implementation at the Release B MSFC DAAC.

*NOTE: The HP K200 SMP depicted in table 3.4.2.3-12 is a low-end SMP class server that is scalable from 1-4 CPUs.*

***Table 3.4.2.3-12. MSFC DAAC Hardware Configuration***

| Component | Class/ Type | Platform | Qty. | Number of Processors | Memory | Disk Capacity |
|---|---|---|---|---|---|---|
| DBMS/Web Server | SMP | HP K200 | 2 | 1 (each) | 256 MB (each) | 25.2 GB (total) |
| Data Specialist and User Support Workstations | Uniprocessor | SUN Sparc 20/50 | 3 | 1 (each) | 64 MB (each) | 4 GB (each) |

Technical Specifications for Candidate DBMS/Web Server Platform:

Make: Hewlett Packard

Model: K200 (Low-End SMP class server)

CPU: PA7200 (upgradeable to future PA800 processor)

Clock Frequency: 100 MHz

Number of processors: 1 to 4

MIPS: 146

TPS: 240

MFLOPS: 40

SPECint92: 136

SPECfp92: 215

Memory: Expandable to 1 GB RAM

Internal Processor-Memory bus bandwidth: 960 MB/sec (peak)

I/O Bandwidth: 128 MB/sec (peak)

### 3.4.2.4 Ingest Subsystem

Ingest subsystem hardware at MSFC is responsible for the ingest, preprocessing, and storage of TRMM LIS Level 0 data products. Ingest subsystem hardware will also be involved in the migration of existing Version 0 data into ECS Release B. No additional Level 0 data products flow into the Ingest Subsystem in Release B compared with Release A, so the Ingest hardware configuration remains stable. Subsystem configuration and specific component sizing rationale are provided in the following paragraphs.

#### 3.4.2.4.1 Rationale

The sizing of Ingest Subsystem hardware both from a system level and a component level is based on the 6/21/95 version of the ECS Technical Baseline. Among the information included in the baseline is:

- data by instrument,
- average daily data volume by level,
- and data destination.

Table 3.4.2.4-1 provides a synopsis of the Ingest data volumes required for Release B at MSFC.

***Table 3.4.2.4-1. MSFC DAAC Specific Ingest Volume Requirements***

| Release A DAAC | Daily L0 Volume (MB/day) | Annual L0 Volume (GB/year) | Version 0 Data Migration Volume (GB) |
|---|---|---|---|
| MSFC | 262 | 95.6 | 772 |

The average expected daily and annual data volumes at each site were calculated from this information and used to determine the required ingest hardware capabilities. Ingest client hosts are sized to accommodate the required ingest volumes as well as I/O and CPU capabilities to support internal data transfers associated with metadata validation and extraction and transfer of data to the Data Server or Processing Subsystems. Working storage disks are sized to accommodate the above functions, as well as provide contingency space for the transfer of more than one days worth of data within a 24-hour period. Since high RMA is a driver for the Ingest Subsystem, all critical components also include some type of sparing or redundancy to ensure that availability requirements are met. The MSFC configuration for Release B is sized for the storage of LIS Level 0 data for one year of operations.

***Queuing Analysis Model*** An Ingest Queuing Model (Imodel) was developed to assist in the sizing of Ingest Subsystem components for the Release B MSFC configuration. This analysis was dependent on a series of model input parameters such as:

- data to be ingested,
- data to be processed,
- data to be stored,
- network component capabilities ,
- Ingest Subsystem component capabilities (e.g. CPU, I/O, disk I/O, operations per byte).

Data flow sensitivity analysis was conducted with respect to changes in data flows and system architecture (parameters). The load presented by each flow in packets per second is a function of the number of bits per second input from the previous process and the mean size of data set that this process expects. Server host read and write operations have associated transfer rate and access time estimates for each data transfer. Conservative estimates of 2 MB/sec are used based on results from Data Server prototyping efforts. Writing of data to the L0 "rolling store" archive, which in Release B is implemented entirely as disk storage, involves the capabilities of the working storage disks, server I/O, and rolling store devices. Finally, the number of copies of data read from the archive and sent to a data sink (e.g., Processing Subsystem) may be varied to determine the additional load of reprocessing on Ingest Subsystem resources.

Analysis of the ingest queuing model developed for the Release A CDR confirms the results of the paper analysis conducted prior to the Release A PDR supporting the ability of the Ingest Subsystem configurations to support Level 0 data ingest requirements. Projected maximum individual component utilization in support of Level 0 data ingest is approximately 10% under nominal L0 data ingest operations. The additional subsystem capacity is available for contingency (e.g., ingest of more than one days worth of data in one day or resolving difficulties encountered during reformatting or metadata validation activities), Version 0 data ingest, and subsystem testing requirements. Inclusion of support for Version 0 ingest functions increases subsystem component utilization to the 40% to 60% range, depending on the required daily ingest volume.

#### 3.4.2.4.2 Configuration

Brief descriptions of the generic components, provided within the MSFC configuration at Release B are provided in Table 3.4.2.4-2. The results of the system design analysis as well at the modeling discussed in Section 3.4.2.4.1, results in a recommended configuration consisting of low to mid-level Symmetric Multi-Processing (SMP) 32-bit machines, capable of supporting multiple network (FDDI) and direct-connect (SCSI II) devices.

Working storage devices are RAID 5 units with a minimum of two days worth of space allocated to ingest working storage required to support the functions of acquiring, processing, validation, and archiving L0 data. This volume of working storage allows for one days worth of L0 data to be staged for processing, an additional days worth available for subsequent ingest, and an additional 25% available to service additional Ingest Subsystem needs (e.g., retrieval support, pre-processing, quality checking). Additional magnetic disk resources are supplied within the Ingest Subsystem to support items such as:

- client host operating system,
- application software and L0 archive database directory information

***Table 3.4.2.4-2 Ingest HWCI Component Descriptions***

| Component Name | Class/Type | Comments |
|---|---|---|
| Client Host | SMP Server W/S / Server W/S | Single or multi-processor workstation-based servers, up to mid-level SMP servers. |
| Working Storage | RAID disk | One or more RAID units, site capacity sized. In Release B, this disk buffer acts as temporary staging as well a longer term "rolling storage" (archive) of L0 data (as applicable) in place of tape based and/or archive robotics based storage. RAID 5 for random access protocol. |

The specific sizing derived from MSFC Release B requirements is synopsized within Table 3.4.2.4-3 and is highlighted in Section 3.4.2 within the site configuration overview Figure 3.4.2-1. The site overview figure provides additional details on specific component configurations and sizing. The Ingest Subsystem resources at MSFC are sized principally for the operational ingest and storage of LIS Level 0 data sets, and to support the migration of data products from Version 0. Modeling analyses have shown that daily ingest of the LIS Level 0 data consumes less than 10% of ingest subsystem resources. Additional available system resources will be utilized to support the Version 0 data migration effort as discussed in Section 3.4.2.4.1. Details of the migration effort are still being worked out, but preliminary estimates of the system resources required to perform the migration range from 30% to 50%. Additional system resources are available for contingency.

***Table 3.4.2.4-3. Ingest HWCI Component Sizing for the MSFC DAAC Configuration***

| Ingest Component | Component Class | Quantity | Comments |
|---|---|---|---|
| Client Host (ICLHW) | SGI Challenge L SMP | 2 | L0 Ingest Client hosts. Hosts are adapted to ECOM I/F and ESN. Host attached disk. SCSI I/Fs to RAID working storage. |
| (Working Storage) | RAID Disk (host attached) | 2 | Host adapted RAID disk arrays. RAID 5. SCSI II adapted & cross strapped to Ingest Client hosts. Functions as working storage and L0 rolling store. |
| Client Host (ICLHW) | 8 mm tape stacker | 2 | Support for hard media ingest from Version 0. |
| Client Host (ICLHW) | X-Terminal | 1 | OPS support for Data Ingest Technician(s). |

### 3.4.2.5 Interoperability Subsystem

For the Release B time frame, the hardware support for the Interoperability Subsystem, particularly the Advertising capabilities are provided by the Data Management HWCI. Please see section 3.4.2.3 for a complete description of this capability.

### 3.4.2.6 Production Planning Subsystem

The Planning Subsystem consists of a single Hardware Configuration Item (HWCI) providing the hardware resources to support its production planning and plan management for data processing production management (plan implementation) functions. The Planning hardware consists of one Production Planning/Management Workstation and a Planning (DBMS) Server.

The Production Planning/Management server supports the Planning operations staff in performing their routine production planning and management functions. A workstation is provided for operations personnel to access management GUIs. These functions include candidate plan creation, plan activation, entry of production request information and report generation. The server and workstation classes chosen are based on planning workloads for that DAAC.

The planning and production database is a key component within the Planning Subsystem with the database server providing the persistent storage for data which are shared between the applications. The database marshals requests for concurrent access to data and provides the protocols to allow applications to be allocated to distributed platforms.

There are two physical servers: one being the Planning Server and the second being the Production Queuing Server (actually allocated within the SPRHW HWCI). These servers act as the primary and secondary unit, with the Planning Server acting as primary. Both physical servers provide DBMS server capacity.

#### 3.4.2.6.1 Rationale

A basis for the PLNHW capacity sizing is provided in the following paragraphs. Section 3.4.2.6.2 provides detailed on-site configuration. The Planning Server being provided at Release A for sites supporting processing operations for TRMM. An estimate for the Planning database sizing and processing loads was made for the Release A and Release B time periods. The results of this sizing indicated that a very small system load would be experienced in the Release A time frame in comparison to the load that would occur during the Release B time period. Therefore, at Release A sites, hardware was sized for Release B requirements; no additional hardware will be required. The following rationale provides insight into the Release B sizing.

The Planning server supports the Planning database that contains all the information central to the functioning of the Planning Subsystem. To size the Planning server it was necessary to estimate the size of the Planning database and determine the database throughput (transaction rates).

The size of the Planning Subsystem server was estimated by developing a model of the Planning Subsystem database and processing loads that would be imposed on the server. The following paragraphs summarize the procedures used, assumptions made and other information used to develop the Planning subsystem workload model for the IDR phase.

1. *Planning DBMS Size* -- The starting point for the sizing effort is the analysis done prior to the ECS PDR for the sizing of the Planning database. This analysis was documented following the PDR in "Planning Subsystem Database Size Estimate for the ECS Project" (440-TP-012-001, February 1995). The fundamental data structures presented in that document remain valid (e.g., PGE Profiles, Production Requests) although some revisions have been made within the data structures. For example, parameters within the data structures related to the number of files per job were effected by the initial assumptions made about the average number of files input to or output from a job. More realistic numbers were used.

2. *Technical Baseline* -- The August 1995 Technical baseline information was used to derive key parameters that effect the planning and processing workload at each DAAC site. These key parameters include the number of job activations per day for each PGE at each DAAC, the number of input files and output files for the PGEs, and the number of PGEs maintained at each DAAC. For example, at EDC during the latter end of the Release B period (epoch k, 3Q99), the following parameters were derived:

   - No. PGEs at the DAAC 54
   - Average number of activations (jobs) per day 630
   - Average number of files input to processing per day, all jobs 6,362
   - Average number of files output from processing per day, all jobs 3,269
   - Average number of files input to an average job per day, per jobs 10
   - Average number of files output from processing per day, per jobs 5

3. *OPS Concept* -- At the Operations Concept Workshop held in June 1995 certain concepts were presented concerning the manner in which the Planning subsystem would be used at each DAAC. These assumptions have been adopted here. In summary:

   a. The production scheduler/planner at each DAAC will prepare and publish a 30 day plan every two weeks. This plan is used to provide some assistance in longer range planning. The 30 day plan is only prepared and published every two weeks - if changes occur after a plan is published, the changes will only be incorporated in the next 30 day plan.

   b. The production scheduler/planner at each DAAC will prepare and publish a 10 day plan every week. This plan will provide a finer grain description of planned activities. Like the 30 day plan, this plan will not be replanned and distributed except on the regular weekly boundaries.

c. The production scheduler/planner at each DAAC will prepare and activate a daily plan or schedule once per day. This schedule will be replanned as required during the course of the day.

It needs to be noted in this regard, and as is described in more detail in the Planning Subsystem design document, that the manner in which each DAAC operations production scheduler/planner decides to conduct planning and scheduling can vary from DAAC to DAAC. The planning and scheduling tools are sufficiently flexible to support a variety of planning and scheduling strategies. The sizing of the storage and the performance of the server is based upon the assumptions given here. It should also be noted that it is not essential that the operations staff conduct replanning for the active schedule if events arise (e.g., processor failures) that would cause the predictions of the active schedule to depart from reality. Processing will continue regardless since jobs will be released for execution as resources (processors and input data) become available.

4. It was assumed that the reprocessing workload in jobs would be equal to the standard processing workload. Additionally, it was assumed that planning and scheduling in support of testing activities would add an additional 10% to the base workload.

5. Several other parameters were estimated as a part of the process of developing a model for the database sizing and processing activity. Some of these parameters and their values are:

   - No. of working hours per day 24
   - No. of long term (30 day) plans stored 5
   - No. of short term plans stored 5
   - No. of production request per PGE 4
   - No. of replans (active plans) per day 4

6. *Volume Estimates* -- Database storage volume estimates were prepared for each DAAC site by summing each of the database tables as applicable to that DAAC site.

7. *Planning Activities* -- The design for the Planning Subsystem was then represented as a collection of several activities or functions (e.g., Subscription Manager, Planning Workbench: Candidate Plan Creation, etc. See Planning Subsystem Design). Functions that were activated only infrequently (e.g., Subscription Submittal) were ignored. The activation frequency of these subsystem activities was then identified, where possible from the August 1995 technical baseline summary, for example number of jobs activated per day. Subactivities within these functions were identified and an estimate of the processing load was made based upon the complexity of the activity. These processing load estimates were made in terms of the number of CPU seconds required for a processor estimated to perform at a 1 MIPS rate - i.e. a low end processing system. In one instance for the Processing subsystem, a key parameter (job submission overhead) was used which was measured during benchmarking of candidate planning & scheduling subsystems prior to the COTS procurement. Amount of I/O activity was also estimated in terms of records read or written and a CPU load estimate was applied to that value as

well. These load estimates were then totaled across the complete set of Planning Subsystem activities for the specified frequency of activation for each DAAC site. Planning Subsystem server sizing is then estimated by scaling upwards from the base processor size.

The RMA analysis performed for the science data production equipment string, does not suggest the need for stringent fail-safe operations. Availability and Mean Down Time (MDT) requirements for the Planning Subsystem function are 0.96 and 4 hours, respectively. Analysis has been performed showing that these requirements are readily met by the Planning Subsystem configuration (Reference: "Availability Model/Predictions for the ECS Project," 515-CD-001-003, July 1995). However, processing must provide a fail-soft environment, therefore in terms of mission suitability the configuration remain at two servers (one standby and one primary) to support science data processing.

Since one server will act as a backup for the other, two servers, with equal capacities are required due to their role in supporting the production planning and task queuing management functions of the entire DAAC's processing complement. In the event of failure of the primary host hardware, transition to a secondary host will be facilitated. Since the primary component is the Planning Server, and the Process Queuing Server is backup, each server will be sized to handle both Planning and Process Queuer Server functions. The Process Queuing server is discussed as part of the Science Processing hardware (SPRHW).

***DATABASE SIZING*** Based on the number of activations per day, per PGE, for a given epoch (as established by the January 1995 ECS Technical baseline which incorporates Ad Hoc Working Group on Production (AHWGP) information), the size of the Planning database is estimated for the specific PGEs allocated to that DAAC site. As discussed above, it was assumed that a 30 day plan and a 10 day plan would be produced as described in the June 1995 operations concept workshop.

Based upon the analysis described above, the estimated size of the Planning database, to support the LIS processing is currently estimated to be around 2.7 Mbytes total for Release A at MSFC. Database sizing estimates are relatively low, and it would be impractical to attempt to install a system to support these sizes and workloads, therefore the MSFC complement is sized for the total mission.

The database sizing estimates are summarized below for the major Planning Subsystem functions for MSFC within Table 3.4.2.6-1.

***Table 3.4.2.6-1. Database Sizing for MSFC Planning and Queuing Functions***

| Sizing Category | Sizing Contribution (Kbytes) |
|---|---|
| PGE Profiles | 4.2 |
| Production Requests | 580.0 |
| DPRs | 56.8 |
| Short Term Plans | 13.9 |
| Long Term Plans | 40.3 |
| Ground Event Plans | 6.4 |

| | |
|---|---|
| Data Availability Predictions | 0.1 |
| AutoSys Tables | 13.9 |
| **TOTALS:** | ***715.6*** |

The total estimated database size at MSFC is approximately 1 MB.

***PROCESSING TIMES*** - The procedure used to develop processing workload estimates is described above. It is essentially a static analysis. Service times for various subfunctions of the Planning and Processing activities were assumed, and an overall workload was computed by this static analysis. Estimates of processing time for the base low-end processor are presented in Table 3.4.2.6-2, which reflect processing times for MSFC.

The desired loading is achieved by scaling from the low-end system performance to the target system performance. Comparative benchmarks for various processing systems have been used to perform the scaling and selection.

It is necessary to consider "critical" or key operational events, however, rather than just a total time and average utilization to determine the adequacy of the design. Two key events occur during the course of the day for the production scheduling personnel - creation of candidate plans and the candidate plan activation. Based upon the analysis described above, approximately 13 seconds of pure processing time would be expected to produce a short term or 10 day candidate plan. I/O wait time would be of the order of 10 seconds at MSFC, resulting in a total time for creation of a candidate plan of approximately 23 seconds. Although processing time can be easily corrected for at relatively little additional cost, I/O wait time cannot be so easily or dramatically improved as I/O time. Processing time can easily be reduced to 20% of the base estimate resulting in a total wait time for candidate plan creation of approximately 13 seconds. This is an operationally workable time for an event that might occur 3 or 4 times per day. A similar analysis can be performed for the creation of an active plan. Two components of this event apply: one part on the planning side, and one part on the processing management or queuing side. Making similar assumptions, it is estimated that activation of a plan would require approximately 64 seconds of processing time and 3 seconds of I/O wait time. Again, processing time can be relatively easily compensated for. With a factor of five improvement in processor speed, the total wait time would be of the order of 16 seconds.

***Table 3.4.2.6-2. Processing Time Estimate For MSFC Planning Functions***

| Planning Function/Activity | Estimated Daily Processing Time (sec) |
|---|---|
| Subscription Management | 12 |
| Planning Workbench<br>- Cand. Plan Create | 26 |
| - Cand. Plan Activate | 60 |
| - Update Active Plan | 43 |
| - Cancel/Modify Active Plan | 60 |
| COTS Manager | 869 |

| | |
|---|---|
| AutoSys Scheduler<br>Reflects: daily schedule update; MSS support; PGE heartbeat; job transitioning; resource management; overhead | 2636 |
| AutoXpert | 1440 |
| PGE Execution Manager | 112 |
| PGE Data Manager | 664 |
| **Total - Planning/Processing** | *5922* |

It is necessary to consider "critical" or key operational events, however, rather than just a total time and average utilization to determine the adequacy of the design. Two key events occur during the course of the day for the production scheduling personnel - creation of candidate plans and the candidate plan activation. Based upon the analysis described above, approximately 13 seconds of pure processing time would be expected to produce a short term or 10 day candidate plan. I/O wait time would be of the order of 10 seconds at MSFC, resulting in a total time for creation of a candidate plan of approximately 23 seconds. Although processing time can be easily corrected for at relatively little additional cost, I/O wait time cannot be so easily or dramatically improved as I/O time. Processing time can easily be reduced to 20% of the base estimate resulting in a total wait time for candidate plan creation of approximately 13 seconds. This is an operationally workable time for an event that might occur 3 or 4 times per day. A similar analysis can be performed for the creation of an active plan. Two components of this event apply: one part on the planning side, and one part on the processing management or queuing side. Making similar assumptions, it is estimated that activation of a plan would require approximately 64 seconds of processing time and 3 seconds of I/O wait time. Again, processing time can be relatively easily compensated for. With a factor of five improvement in processor speed, the total wait time would be of the order of 16 seconds.

Bench marking and prototyping activities are underway at the time of publication of this document. Information acquired from this process will be used to assess integration issues as well as obtaining more precise performance and capacity measurements, especially in helping to define total mission requirements which pose a more significant load than for initial operations at MSFC. As the prototypes mature, observed performance characteristics under simulated request load will be used to check / refine / replace the various assumptions made in the sizing efforts.

#### 3.4.2.6.2 Configuration

The Planning Subsystem is a single HWCI providing hardware resources to support production planning and plan management for data processing production management (plan implementation) functions. The Planning hardware consists of a Planning Server and one or more Production Planning/ Management workstations.

The PLNHW server architecture is based primarily on providing facilities with which a common RDBMS for planning and queuing can be serviced. The Planning Server acts as the primary and the Production Queuing Server (allocated within SPRHW) acts as the backup. Both Planning Server and the Production Queuing Server are identical units.

As discussed in the rationale above, database sizing and processing were evaluated for Release A resulting in relatively insignificant performance and capacity requirements, therefore the system is configured to support current estimates for total capacity to avoid unnecessary swap-outs of hardware while parallel operations are underway. Note that MSFC platforms are sized for the entire TRMM mission.

Provided capacities for the Planning Subsystem platforms within the configuration are summarized here:

- Planning Server: Sun SPARC 20/71
  - Clock: 75 MHz
  - CPUs: 1
  - Disk: <1 GB minimal configuration, plus capacity supplied due to procurement units, which results in a total of: *6GB* (includes allocation for Sybase work and swap space).
  - RAM: 384 MB
  - TPC: SPECint92 = 125, SPECfp92 = 121
- Planning Workstation: Sun SPARC 20/50
  - Clock: 50 MHz
  - CPUs: 1
  - Disk: 2 GB
  - RAM: 64 MB
  - TPC: SPECint92 = 82, SPECfp92 = 89

The site configuration overview diagram, Figure 3.4.2-1 depicts the PLNHW hardware components at MSFC, within the context of the overall site configuration.

### 3.4.2.7 Data Processing Subsystem

The Data Processing Subsystem (DPS) consists of three hardware CIs:

a. *Science Processing* -- the primary HWCI in the Processing Subsystem and contains staging (working storage), input/output (I/O), and processing resources necessary to perform routine processing, subsequent reprocessing, and Algorithm Integration & Test (AI&T). SPRHW CI consists of two components: Science Processing which provides a pool of cluster configured processing resources, and Processing Queue Management which provides the workstation(s) required to manage, control and status tasked dispatched to the processing resources.

b. *Quality Assessment and Monitoring (AQAHW)* -- This HWCI contains the hardware necessary to support DAAC operations users performing planned routine QA of product data. At a minimum, the hardware can be configured for general user and subscription use (client support). This HWCI may, over time, consist of QA monitors and

workstations ranging from X-terminals, to small user workstations, to medium or large graphics workstations. The complement is site dependent and is a function of the classes of production performed. The need for visualization support will be explored as product specific QA processes and requirements are worked jointly with the DAAC operations personnel as well as the science teams.

c. *Algorithm Integration and Testing (AI&T)* -- This HWCI provides the hardware resources to support DAAC operations users performing: science software algorithm integration and test , systems validation and integration and test. This HWCI provides the workstation and server based operations support hardware, while the prime science software integration and test capacity is provided within the SPRHW HWCI (i.e. no science processors are provided by the AITHW CI to the DAAC configuration). The AITHW HWCI provides the operations support workstations to allow DAAC personnel to configure, control and manage the AI&T processes engaged on the target science processes. AITHW also has provision for a small dedicated DBMS server to support AI&T., which does not interfere with the operational environment

DPS is responsible for managing, queuing, and executing processes on a specified set of processing resources at each DAAC site, and operates in conjunction with the Planning Subsystem.

The overall hardware design for ECS is that of a heterogeneous computing environment. The configuration highlighted here includes the CDR level design for Release A and IDR level design extensions for Release B for platform suitability, scalability and evolvability. The candidate hardware is tailored to DAAC unique instrument processing needs.

#### 3.4.2.7.1 Data Processing Rationale

The purpose of the system level performance and capacity analysis is to provide a basis for sizing for Processing, Data Server and Ingest Subsystem capacity as a system. The subsystems are viewed as parts of an integrated system as static and dynamic analysis are applied to generate recommended configurations.

The rationale supplied here addresses SPRHW, AQAHW and AITHW. The sizing for SPRHW focuses heavily on science processor MFLOPS, I/O, communications and host attached disk requirements. As indicated above, this analysis meshes with the Ingest, Data Server and Communications sizing, and to a lesser degree with the Planning analysis as well. Rationale for the configuration recommendations are provided below for SPRHW, AQAHW and AITHW in turn below.

***WITH RESPECT TO THE SPRHW HWCI:*** For Release A CDR and Release B IDR, sizing rationale was based on one shift operation (i.e. 8 hours a day, 7 days a week or "8/7") at MSFC. The 8/7 operation at MSFC for CDR represents a baseline change from PDR, which was 24 hour a day operation. Release B performance and capacity are analyzed to understand scalability and migration from Release A to Release B.

The following major driving requirements govern the sizing rationale for the processing hardware:

- RMA requirements,
- capacity phasing (discussed below in detail),
- June 1995 ECS Technical Baseline, incorporating AHWGP estimates for Release A CDR and the August 1995 Technical Baseline for Release B IDR
- Hardware suitability (software support, mission support) and scalability
- Parallel AI&T and production operations (at the operational sites)

Release A performance and capacity analysis is based upon the June 1995 Technical Baseline/ AHWGP data. Release B analysis is based upon the August 1995 Technical baseline. The LIS PGEs are now three processes consisting of once a day, once every 15 days, and once every 30 days. LIS processing requirements are very low.

Capacity phasing rules, which are part of the ECS Technical Baseline, are applied to the calculated capacities to produce the required capacities for the project phase in question. The following bullets describe the required phasing factors and how they are applied to processing capacity based on launch dates. This phasing is applied to each processing platform. Since for MSFC TRMM Release A operations we are sizing for the entire LIS mission, all phasing rules apply.

- **0.3X for L-2 < t < L-1** For pre-launch AI&T starting at launch minus 2 years, AI&T requires 0.3 times the processing estimate at launch during the period 1 to 2 years prior to launch, where X is defined as at-launch processing estimate for pre-launch AI&T.
- **1.2X for L-1 < t < L+1** For pre-launch AI&T and system I&T, starting at launch minus 1 year, AI&T and system I&T requires 1.2 times the processing estimate at launch during the year prior to launch. Standard instrument processing requirements begin from launch date and last for the remainder of the life of the instrument. Again, X is defined as the at-launch processing estimate for pre-launch AI&T and systems I&T.
- **2.2X for L+1 < t < L+2** For post-launch AI&T, standard processing, and reprocessing of data, starting at launch plus 1 year, 2.2 times the standard processing estimate is required. X is defined as the standard processing estimate for that period.
- **4.2X for t > L+2** For post-launch AI&T, standard processing and reprocessing of data, starting at launch plus 2 years, 4.2 times the standard processing estimate is required. X is defined as the standard processing estimate for that period.

The configuration shown here for LIS at MSFC, is based on the 4.2X rule for capacity.

Spreadsheet analysis (or static analysis) results are initially presented for Release A (Epoch e) and Release B (Epoch k) sites. Performance and data volume demands are summarized and translated into average processing (MFLOPS), input/output, (I/O) and network bandwidth requirements. The spreadsheet results are time-averaged over the daily operations period.

Dynamic modeling assesses effects of process dynamics including both nominal and peak resource requirements. Both spreadsheet and dynamic modeling results are based upon "one times" (1x) standard processing. Dynamic model results are evaluated for the same Release A

and Release B sites, corresponding epochs, and AHWGP data. The Release A dynamic modeling effort focused on the TRMM mission sites: LaRC and MSFC.

***STATIC ANALYSIS*** Table 3.4.2.7-1 below provides a synopsis of the static analysis of the AHWGP requirements for MSFC.

***Table 3.4.2.7-1. Static Analysis Summary Results of June 1995 Baseline Data-Release A AHWGP Requirements for MSFC***

| Instrument | Site | Processing (MFLOPS | Backplane I/O (MBps) | Network I/O (MBps) | Archive I/O (MBps) |
|---|---|---|---|---|---|
| LIS | MSFC | 5 | 0.14 | 0.05 | 0.04 |

For 8/7 operation at MSFC in Release A, the TRMM LIS machine(s) rated processing requirement, given above accounts for a machine efficiency of 25% (a factor of four was applied to the rolled up numbers). Capacity phasing factors that are applied to the calculated are incorporated into the final sizing given later. The purpose of the static analysis is to provide a check against the Dynamic Analysis, with the later analysis providing the core sizing data for the site configuration. A comparison of the processing figures, to the dynamic peak and nominal predictions is discussed later.

The static analysis has been updated to reflect the August 1995 Technical Baseline (See Table 3.4.2.7-2. The processing and I/O requirements increased due to the revised characterization of the 15, 30, and 1 day characterization of the LIS processes, but on a relative basis the processing and I/O requirements are still low.

***Table 3.4.2.7-2 Static Analysis Summary Results of August 1995 Baseline Data-Release A and B AHWGP Requirements for MSFC***

| Instrument | Site | Processing (MFLOPS | Backplane I/O (MBps) | Network I/O (MBps) | Archive I/O (MBps) |
|---|---|---|---|---|---|
| LIS | MSFC | 12.1 | 0.36 | 0.1 | 0.05 |

MSFC LIS platforms are sized for the LIS mission in total. All growth factors are applied in the initial delivery to MSFC and are reflected in the sizing given. Numbers on provided capacity are adjusted to include growth for the mission lifetime. Assuming a 25% machine efficiency and a 4.2 X phasing factor, LIS processing requirements are therefore calculated to be: 50.8 MFLOPs. Required back plane I/O at MSFC is 0.36 MB/sec, which low given the machine class required due to the processing loads. These requirements translate into a workstation class machine, supporting LIS.

***DYNAMIC ANALYSIS*** The Dynamic Model (ECS System Performance Model) was run to assess dynamic performance of production processing for both Releases A and B. This model provides data with respect to peak and average resource consumption while simulating a resource constrained environment which is not possible with static analysis alone. Static or spreadsheet analysis provides time averaged data over the daily operational period.

Dynamic modeling results are summarized below in Table 3.4.2.7-3 for MSFC primary processing in single shift operation. Release A was evaluated for LIS at MSFC during Epoch e.

***Table 3.4.2.7-3 One Shift Operation Performance and Capacity***

| MFLOPS | Host Disk-Max. GB | Host Disk-Avg. GB | DH Disk-Max. GB | DH Disk-Avg. GB | Avg. N/W BW to DS MBps |
|---|---|---|---|---|---|
| 5.04 | 0.237 | 0.02 | 0.447 | 0.0746 | 0.05 |

Dynamic modeling was compared to static modeling results as a cross check. Average processing results correlated between the two, where the average number of CPUs required in one shift operation in dynamic modeling versus static modeling was the same.

Requirements specify that capacities be allocated to 25% processing, 50% reprocessing, and 25% to the remaining activities including primarily AI&T. Backup to Production processing will be provided by the AI&T science processors in order to support our processing operations fail-soft requirement. In addition, for Release A, MSFC is sized for the total TRMM LIS mission requirements. Given these guidelines, and the smaller scale processing, I/O and staging requirements given above for the core 1x processing, the resultant configuration easily addresses the core requirements.

However, given the requirement for fail soft processing operations as well as the requirement to support separate and parallel test and operations activity, the configuration consists of two workstation class machines, scaled to meet the total mission phasing capacity of 4.2x. Refer to the following section 3.4.2.7.2, which describes the provided configuration.

***WITH RESPECT TO THE AQAHW HWCI:*** The Algorithm Quality Assurance HWCI (AQAHW) contains hardware resources to support DAAC operations users performing planned routine QA of product data (non-science QA)**.** This HWCI facilitates the performance of "DAAC based" QA (non-science QA). While the actual processing resources are included within the SPRHW, this HWCI provides the basic facilities to control and enable QA as a process within each DAAC facility (as needed per site specific science and operational policies).

This HWCI does not necessarily support the other primary forms of QA currently envisioned to be supported by ECS: in line QA and SCF based QA. These forms of QA are supported by other HWCIs as well as subsystems within the SDPS. Capacity to directly support in-line QA is supported by the SPRHW hardware discussed earlier in this section and is considered as part of the ECS Technical Baseline AHWGP information. It is currently assumed that the AHWGP data includes factors for inline QA and that other forms of QA will be addressed in the future.

QA processing requirements are currently being jointly evaluated with the investigative teams. Current operational assumptions include DAAC QA (non-science QA) process performed at the sites in conjunction with SCF-based QA. The current design baseline thus includes local QA monitors for the operational TRMM sites at Release A (that is, those sites which provide for routine standard processing). Sites not providing routine processing as part of TRMM operations do not contain AQAHW unit(s) within their configuration.

Given the boundaries and conditions described above, there are further assumptions which govern the design rationale for this site's AQAHW hardware complement. They are as follows:

- *Type of QA* -- This support (non-science QA) is not necessarily equivalent to SCF QA, and the type of support required is a DAAC specific issue.
- *OPS Concept* -- The AQAHW provides client-like access to production data for purposes of time series analysis, visualization checks, report generation, etc. The types of QA to be performed is DAAC dependent, and is expected to be essentially data integrity checks (products, metadata). These local QA monitors are actually similar to Science User workstations equipped with core Client subsystem functionality. These QA monitors, with one or more at a DAAC site, act as QA Clients to the Data Processing components and the Data Server.
- *Software* -- In addition to the core ECS provided software functionality (e.g. client, etc.), the current concept, under investigation, assumes that these QA monitors host DAAC supplied processes, which use a subset of the ECS services provided primarily by the Data Server and Client subsystems to "pull" production data sets under the *subscription* mechanism, for data integrity checking. These software loads, with respect to memory, disk and processing load cannot be characterized at this time. However, it is likely that if significant processing is required, the QA workstation would not serve as the execution platform, but processing tasks would be dispatched to the SPRHW provided science processors as an option instead.
- *Visualization* -- It is assumed, worst case, that visualization would have to be provided to support the QA. This assumed requirement helps to define the platform type based on the form of data in question.
- *I/O Load* -- Depending upon the operational requirements of the DAAC and the Science Teams (under investigation), this QA can involve full or statistically determined "pull" loads from the production system through the Data Server. Drastically different local data flows can result based on these requirements resulting in differing QA monitoring workstation and communications configurations. These decisions are DAAC specific. However, since requirements are not clear in this area, we have assumed the following for the operational sites:

  *Load = 20% of the average daily routine production (e.g. one in five check)*

  *Therefore....*

  *MSFC network I/O load = 20% of 86 MB/day (across 8 hours)*

  *= 17.2 MB /day or < 1 KBps (approx. <5 KBps, burst)*

  *= 8 Kbps nominal network traffic data rate*

This pull load is a fraction of the existing x2 daily distribution supported by the Data Server configuration. We assume the QA load is spread across the operational hours, unique to this site at Release A (that is they are nominal loads).

Platform I/O is characterized as a multiplier against the assumed network ingest. This multiplier is applied to allow for internal staging and a factor for read/write access to data and to disk in general. The assumption here is:

*Internal (back plane) I/O = 4 x network I/O rate*

*Therefore....*

*MSFC QA W/S I/O = 4 * 5 KBps (peak), 4 * 1 KBps (nominal, for 8 hrs.)*

*= << 1 MBps nominal*

- *QA Host Disk Storage* -- This is difficult to size accurately at this time due to the uncertainties within the requirements. However, some assumptions are made which are a function of this site's unique processing and data archival requirements. The major disk sizing assumptions are as follows:
  - Must support simultaneous receipt of production "granules" in parallel to supporting ongoing analysis on data already captured. (A multiplier of x2 is assumed here, which is minimal and could be tuned upwards).
  - The largest granule, particular to the site, must be supported.
  - Contingency capacity is supplied to support storage of time series statistics, reports and the like (assumed to be minimal in size).

*Disk Volume Needed = 2 * [(20% of Daily Production) + Contingency]*

*Therefore....*

*Contingency capacity for reporting and tracking is assumed to be 10% for MSFC:*

*MSFC QA Disk = [2 * ( 20% * 86 GB/day ) ] * 1.1*

*= 37.8 MB (far less than 1 GB), plus additional factors below:*

*The large products to be QA'ed , or used in QA, in this time frame include...*

- *LIS at 360 MB,*
- *with LIS browse at 85 MB (one per orbit, 16 per day)*

*Application of a 2 GB disk would allow for temporary storage of multiple production set instances, and yet have reserved capacity for report storage and maintenance of time series statistics.*

The MSFC requirement for a QA workstation, given the design assumptions above requires a minimally configured graphics workstation with up to 2 GB of disk and Ethernet to FDDI (as an option) network access. This requirement is so minimal that existing workstation capacity with in SPRHW and/or PLNHW is likely to cover the requirement. A workstation may be provided for operations suitability as an option.

***WITH RESPECT TO THE AITHW HWCI:*** The Algorithm Integration & Test HWCI (AITHW) provides essentially the same configuration at Release A that was provided at Ir1.

Operations workstations and a small server are provided to support the AI&T activity, which utilizes AI&T capacity provided by the SPRHW Science Processors to actually host and test the science algorithm software applications. Thus, the AITHW HWCI just provides the operations support workstations to allow DAAC personnel to configure, control and manage the AI&T processes engaged on the target science processors.

The design rationale supplied for the Ir1 components applies, and is not repeated in this volume. AI&T requirements, which increase at Release A for configurations that were supplied at Ir1, affect the SPRHW hardware CI, not the core of the operations support hardware which is supplied within AITHW. See the site specific design rationale discussion provided earlier within this section for AI&T science processing capacity information as well as the supplied configuration discussed in the section that follows.

### 3.4.2.7.2 Processing Configuration

The specific provided configurations for the Release A MSFC SPRHW, AQAHW and AITHW HWCIs, as derived from the rationale described above, is synopsized below. Figure 3.4.2-1, which provides the full details for the site's configuration, include layouts for these HWCIs. Additional details on specific component configurations and sizing are provided within the figures (including make and model numbers assumed as candidates for implementation).

Table 3.4.2.7-3 summarizes the *required* capacities vs. the recommended data processing platform's *provided* capacities within the recommended configuration. The AHWGP required capacities are derived from the sizing efforts briefly outlined in 3.4.2.7.1 above. Required capacities were modified given the assumptions discussed in the table notes below.

***Table 3.4.2.7-3. Provided Processing Capacity for the MSFC Science Processing Configuration***

| | | AHWGP Required Capacity | | | Provided Capacity | | | |
|---|---|---|---|---|---|---|---|---|
| **DAAC** | **Rel** | **MFLOPS** | **Band-width** | **Disk Volume** | **Platform** | **Peak MFLOPS** | **Peak I/O Bandwidth** | **Disk Volume** |
| MSFC | Ir1 | 10 | 25 MB/sec | 5 GB | Uni-processor WS | 125 | 100 MB/sec | 6 GB |
| | Rel A | +40.8 | No Change | +5 GB | +Uniprocessor WS | +125 | +100 MB/sec | +6 GB |

Notes:
a. ESDIS phasing factors and machine efficiencies are applied.
b. I/O bandwidth per static analysis for MSFC was < 1 MB/s, respectively. Representative vendor minimum was assumed.
c. MSFC provided capacities for Release A is based upon epoch e AHWGP data.
d. "AHWGP provided capacity" is based on static analysis. Dynamic analysis was used to derive the "provided capacity".

The core processing requirements at MSFC do not inherently call for two workstations. However, due to the fail-soft processing requirements, two machines are provided. A second is

added at Release A, to the core capability provided at Ir1. The system RAM allocation of 256 MB is not altered in the operational configuration (further joint analysis with the MSFC science and algorithm teams may require re-assessment of the RAM configuration in the future).

The Process Queuing Server, which serves as the secondary Planning and Queuing Server, is shown in the site overview diagram. It is identical to the primary server, the Planning Server within the PLNHW HWCI.

***AQAHW*** The MSFC requirement for a QA workstation requires a minimally configured graphics workstation with up to 2 GB of disk and Ethernet to FDDI (as an option) network access. This requirement is so minimal that existing workstation capacity with in SPRHW and/or PLNHW is likely to cover the requirement.

Therefore, it is recommended at this time that no stand alone capability be provided due to the number of available OPS workstations already configured at the site as well as the excess processing capacity provided within SPRHW as shown in the table above. A workstation may be provided in the future as a growth option.

***AITHW*** The MSFC requirement for a AI&T server and OPS workstation doesn't change given that the SPRHW provides the science processing capacity. The Ir1 configuration supplied prior to Release A remains in place and is not augmented further.

#### 3.4.2.8 MSS and CSS Subsystems

The MSS and CSS Subsystem hardware have been sized and configured in a redundant configuration in order to provide for high availability of communications infrastructure and management services. The sizing rationale, therefore, applies to both MSS and CSS servers and will be presented in a single subsection.

The MSS Subsystem consists of a single hardware CI (MSS-MHWCI), which provides the servers, workstations, and printers needed for all local system management functions. The MSS-MHWCI provides processing and storage for the following MSS software components:

- Management Software CI (MCI) - provides system monitoring and control (via HP Openview), the database management system (Sybase), trouble ticketing (Remedy), fault management (Tivoli)**,** and management data access (custom code / scripts used to import log file data to the RDBMS)
- Management Logistic CI (MLCI) - Site and SMC maintenance and operations staffs will rely on configuration management to provide software change control (Clearcase), change request management (DDTS) and baseline management.
- Management Agent CI (MACI) -Agents are processes used to monitor and/or control managed objects distributed across heterogeneous platforms. Current COTS technology for network management uses network protocols such as SNMP to provide a way for the manager, the managed objects, and their agents to communicate. SNMP defines specific messages, referred to as commands, responses, and notifications.

The CSS Subsystem consists of a single hardware CI (CSS-DCHWCI), which provides the server for all CSS functionality. CSS contains a single CI, the Distributed Communications CI, which provides the following services:

- Common Facility Services - includes electronic mail, file access, bulletin board, virtual terminal, and event logger services
- Object Services - includes security, naming, message passing, event, thread, time and life cycle services
- Distributed Object Framework - includes OODCE framework functionality.

#### 3.4.2.8.1 Rationale

The MSS/CSS processing complement for MSFC was designed and sized for both the TRMM and AM-1 missions. The sizing of MSS/CSS subsystem hardware is based on the 6/21/95 version of the technical baseline. Storage requirements have been rounded upward.

***Processing Requirements*** Processing requirements for the MSS and CSS subsystem are driven by the following types of transactions:

- HP Openview data collection from managed objects and ad hoc queries (server)
- Conversion / import of HP Openview and log file data to MSS Sybase DBMS (server)
- DBMS usage for report generation / ad hoc queries (server)
- Fault management notification (server)
- Trouble ticketing (server)
- Usage for configuration management, baseline management, and associated report generation (workstation)
- DCE logical server transactions (directory, security, time).

***Server Sizing*** ECS already has experience with many of the COTS products to be loaded on the MSS server from previous work in Evaluation Prototypes (EPs) and EDF installations. Based on this experience, a profile of the MSS/CSS server that is operating under nominal load (e.g., HP Openview map is displayed, but no collections are in process) has been developed. To this, processing requirements have been added for specific types of transactions.

In the EDF, an HP 9000/735/125, rated at 160 MIPS, was loaded with HP Openview, DCE client, Sybase server, X-server, and operating system. Tests were run to examine the impact of various types of HP Openview functions on CPU utilization. HP Openview was configured to discover approximately 500 nodes within EDF and then displayed them as a node map. Minimal status polling was performed at 15 minute intervals. A variety of HP Openview on-line reports were generated to show such items as packet throughput and CPU utilization. During the testing, processes resident on the server were monitored. CPU utilization remained extremely low (i.e., less than 3%) except during operator queries and initialization. At system start-up, initialization of the various daemons used by HP Openview generated a load of approximately 50%. After start-up, functions that involved initialization of x-windows screens (e.g., generation of the node

map or display of a performance graph) generated loads of 25-40% for a brief (less than 15 seconds) period of time. Multiple SNMP queries on a router increased CPU usage to approximately 20 percent, with the primary driver appearing to be the x-windows server. Simultaneous queries of two routers (to two different x-window screens) consumed a total of 50-60% of the CPU. Based on this benchmark, we assume that a basic configuration of a server, including HP Openview, Sybase, DCE client, and the operating system will require approximately 72 MIPS, and will provide adequate resources for routine HP Openview operations. To this must be added processing capacity to handle DCE server functions, HP Openview monitoring, processing of log files, Sybase report generation / ad hoc query capability, Remedy, and mail.

HP Openview and log file-to-Sybase data conversion are primary processing drivers that are expected to vary by DAAC. Table 3.4.2.8.1-3 shows estimated numbers of transactions for HP Openview data collection. HP Openview data collection is driven by the number of managed objects to be monitored and the number of MIB objects to be collected for each. Managed objects for each MIB type were counted based on the Release A CDR hardware plan for MSFC (see Figure 3.4.2-1) and an assumed worst case for Release B. The number and frequency of data collection for each class of managed objects was provided by MSS developers (see 311-CD-003-003, Appendix B). HP Openview provided an estimate of 100,000 instructions per transaction. Using this information, an average number of instructions per second required for HP Openview data collection was developed. These estimates appear to be reasonably in line with HP-provided performance information, which indicates that an HP 9000/735, a machine rated at 125 MIPS, is capable of performing approximately 1300 collections per second.

An estimate of 100,000 instructions per transaction was assumed for the conversion of each logged event to Sybase, based on the number of source lines of code for the MSS MDA component involved and an estimate of instructions needed to update the Sybase database. Instructions per transaction was multiplied by the number of logged events, including both HP Openview events and events collected from applications via the logging API. HP Openview events (transactions) are described in the previous paragraph. The number of application-generated log files, see Tables 3.4.2.8.1-1 and 3.4.2.8.1-2, was developed using the following assumptions:

- One log file (average 192 bytes each) is generated for every system transaction, by every process that is included in the transaction thread.
- The number of “pull” transactions is based on the user model and reflects user service requests by DAAC. Pull transactions (e.g., directory, inventory search requests) are assumed to generate a conservative estimate of 10 log entries each from CIDM and data server processes.
- The number of transactions on the “push” side includes external (DAAC-to-DAAC and L0) file transfers (4 log files each), processing-to-archive requests (4 log files each), and PGE execution (2 log files each). Push transactions were based on AHWGP data, which showed that MSFC executes 15 PGEs per day and each PGE requires an average of 39 input/output file requests at Release A. At Release B, MSFC executes 3 PGEs, and we

assumed the same number of input/output file requests (this was expressed as an hourly average in the tables below for consistency).

- In addition, major processes generate a log file of approximately 512 K (based on the MSS application MIB) once every 15 minutes. There are estimated to be 15 processes at each DAAC that will generate log files every 15 minutes.
- Log files and HP Openview data will be kept for 14 days prior to archiving in long-term Data Server Storage.

The MIPs required to import the total number of log files per day are given in Table 3.4.2.8.1-4.

***Table 3.4.2.8.1-1. MSFC Log File Storage Volume - Release A***

| Log File | Log Events per Transaction | Transaction Frequency per Hour | Total Logged Events per Hour | Bytes per Transaction | Total Size of Bytes/Hr | 14-Day Storage Requirements (MB) |
|---|---|---|---|---|---|---|
| User service requests | 20 | 1 | 20 | 192 | 3,840 | 2 |
| PGE execution | 2 | 1 | 2 | 192 | 384 | 1 |
| External file transfers | 4 | 1 | 4 | 192 | 768 | 1 |
| Processing-to-Archive Requests | 4 | 39 | 156 | 192 | 29,952 | 10 |
| Application MIB poll | 15 | 4 | 60 | 512 | 30,720 | 11 |
| Total | | | | | 65,664 | 25 |

***Table 3.4.2.8.1-2. MSFC Log File Storage Volume - Release B (1 of 2)***

| Log File | Log Events per Transaction | Transaction Frequency per Hour | Total Logged Events per Hour | Bytes per Transaction | Total Size of Bytes/Hr | 14-Day Storage Requirements (MB) |
|---|---|---|---|---|---|---|
| User service requests | 20 | 10 | 200 | 192 | 38,400 | 13 |
| PGE execution | 2 | 1 | 2 | 192 | 384 | 1 |
| External file transfers | 4 | 1 | 4 | 192 | 768 | 1 |

***Table 3.4.2.8.1-2. MSFC Log File Storage Volume - Release B (2 of 2)***

| Log File | Log Events per Transaction | Transaction Frequency per Hour | Total Logged Events per Hour | Bytes per Transaction | Total Size of Bytes/Hr | 14-Day Storage Requirements (MB) |
|---|---|---|---|---|---|---|
| Processing-to-Archive Requests | 4 | 39 | 156 | 192 | 29,952 | 10 |
| Application MIB poll | 15 | 4 | 60 | 512 | 30,720 | 11 |
| Total Rel B | | | | | 100,224 | 36 |

***Table 3.4.2.8.1-3. MSFC HP Openview Collection Processing Requirement***

| | # MIB Objects | Average Size (Bytes) | LaRC Managed Objects | Collections per hour* | Collections per second | Estimated MIPS |
|---|---|---|---|---|---|---|
| R-A MSFC (Hosts, RDBMS, Router, hubs) | 1,953 | 4 | 54 | 39,768 | 11 | 1.1 |
| R-B MSFC (Hosts, RDBMS, Router, hubs) | 1,953 | 4 | 54 | 39,768 | 11 | 1.1 |

* Note that the number of collections per hour was derived by multiplying each class of MIB objects (e.g., MIB II objects) by the number of managed objects within that class, and summing the results.

***Table 3.4.2.8.1-4. MDA Data Conversion to Sybase Processing Requirement***

| | Total HP Openview Events / Day | Total Log File Events / Day | MIPS for 8 hour Sybase import |
|---|---|---|---|
| Release A | 954,432 | 5,808 | 3 |
| Release B | 954,432 | 10,128 | 3 |

At Release A, only ad-hoc queries and reports will be generated from the Sybase database, which will be relatively small. Queries are not expected to exert a substantial load on the server. At Release B, an additional workstation may be used as a Sybase server. Sybase performance benchmarks will be run as Release B reporting requirements are defined in order to better analyze server / workstation capacity needs.

DCE has been installed in the EDF and used in the Engineering Prototypes (EPs). Running on an HP 715, rated at 77 MIPS, the DCE server functions used 8% of the CPU, or approximately 6 MIPS. An analysis was performed to determine how much additional load would be placed on the DCE server at Release A and B.

Load imposed on the DCE server is a function of the number of directory, security and time look-ups from client applications. A client application maintains its own cache containing the most recently accessed directory and security information, and will only access the server when a user is not found in its own cache. The client cache is sized at 512 KB or 1/2 percent of the client memory, whichever is greater. This enables storage of approximately 425 directory and security records (a directory record is 1000 bytes; a security record is 200 bytes) at each client. Many client applications will only access other clients within the DAAC, and so will never exceed their cache. CIDM and the Data Server APC, however, will be directly accessed by external user clients and so will need to access directory and security information for each user access. At Release A, given the user baseline of 448 total ECS users, it is unlikely that any client at a single DAAC will exceed its cache storage; therefore, after the initial access for each client, the server may not be accessed again for directory and security information, unless re-initialization occurs. At Release B, the user model reflects a maximum of 10 users accessing a MSFC per hour. Given that a directory and security lookup typically requires less than 0.5 seconds, it is unlikely that there will be more than 1-2 simultaneous hits on the DCE server. We estimate that 1 additional MIP processor capacity will be sufficient for the level of DCE accesses required.

The processing load imposed by the Tivoli server functions are estimated to be 5 % of the system CPU or approximately 9 MIPs. This is based on the application running on a HP J210/1, rated at 176 MIPs. The estimate includes processing required to generate fault notifications.

Remedy was evaluated on the HP 9000/735/125 for CPU utilization. The application required very little CPU allocation (<1%). A more significant load was present when performing browse or ticket assignment functions (approximately 6%). Submittal and processing of a trouble ticket required less that 1% of the CPU capacity.

The server requirements, as dictated by the rationale given above, is synopsized in Table 3.4.2.8.1-5.

***Table 3.4.2.8.1-5. CSS/MSS Server Configuration - Requirements Estimate (1 of 2)***

| Server Load Sources | Estimated R-A MIPS | Estimated R-B MIPS |
|---|---|---|
| Basic configuration (includes HP Openview and DCE client)* | 72 | 72 |
| Additional HP Openview data collection* | 1 | 1 |
| Sybase Server and Client* | 30 | 50 |
| Tivoli* | 9 | 9 |
| Remedy | 11 | 11 |
| MDA (log conversion to Sybase) | 3 | 3 |
| MSS Agent* | 3 | 3 |

***Table 3.4.2.8.1-5. CSS/MSS Server Configuration - Requirements Estimate (2 of 2)***

| Server Load Sources | Estimated R-A MIPS | Estimated R-B MIPS |
|---|---|---|
| DCE server (including additional processing for peak directory and security transactions)* | 6 | 7 |
| Word Processor | 1 | 1 |
| Spreadsheet | 1 | 1 |
| Other Common Services (Mail, file transfer, etc.)* | 5 | 5 |
| Total | 117 | 147 |
| * These items were considered to be potentially active at the same time. MDA database update is assumed to be run in off-peak hours, and not concurrently with Sybase report generation functions.) | | |

***Workstation Sizing*** On the MSS workstation, the biggest drivers will be the MLCI software COTS which includes software change management (Clearcase) , change request management (DDTS), and the baseline control management. In addition, the MSS Workstation will contain the Sybase client, DCE client, Tivoli client, MSS agent, and operator tools. Although the CM database will be much larger at the DAACs, it is expected to be more stable than in a development environment, requiring fewer updates and fewer extractions. In the EDF, Clearcase was installed on a SPARCstation 10, equipped with 120 MB RAM, rated at 109 MIPS, and with an ethernet interface. The SPARCstation 10 was initially used for Tool kit development, as well as CM of the Evaluation Prototypes. With moderate numbers of users, the SPARCstation 10 provided good performance. At peak use (15-20 simultaneous users viewing items, manipulating the contents of the database, and executing directly out of Clearcase), performance was adversely affected. Usage at the DAAC is not anticipated to require more than 5 simultaneous users, frequency of use is anticipated to be much lower, and applications will not be executed from the Clearcase tool. Although additional bench marking or analysis will help determine the precise Clearcase processing requirements at the DAAC, EDF experience suggests that a workstation configuration in the SPARCstation 20 range should be adequate to support Clearcase, other MLCI COTS, and DCE, Tivoli, and Sybase clients.

DDTS processing requirements are considered modest (as specified by the PureDDTS Administrator's Manual). It is recommended that DDTS share existing CPU and disk resources. An estimate of 3 MIPs is specified for processing load.

Table 3.4.2.8.1-6, *MSS Workstation Configuration - Requirements*, reflects a best estimate of load to be imposed on the MSS workstation. It assumes that most functions run concurrently. Two workstations are planned to support MSS functionality at Release A, and determined additional workstation(s) for support at Release B. The intent is to allow operator functions to be spread across workstations in such a way as to minimize load.

***Table 3.4.2.8.1-6. MSS Workstation Configuration - Requirements***

| Workstation Load Sources | Estimated R-A and R-B MIPS |
|---|---|
| Basic configuration (includes Clearcase and Operating System)* | 50 |
| Inventory Manager, Change Request Manager, Baseline Manager* | 20 |
| **Tivoli Client*** | 5 |
| **DDTS*** | 3 |
| Sybase Client* | 10 |
| Word Processor | 1 |
| Spreadsheet | 2 |
| Graphics | 1 |
| MSS Agent* | 2 |
| DCE Client* | 5 |
| Other Common Services (Mail, file transfer, etc.) | 5 |
| Total : (Items with asterisk were considered potentially active at the same time) | **95** |

***Storage Requirements*** Major datastores for the MSS and CSS subsystems include: HP Openview files, application log files, the Management DBMS, and Clearcase-managed data for software change management.

Other significant datastores include DCE directory and security data, mail, and the following databases; trouble ticketing, Tivoli, DDTS and baseline control management data.

The size of the data storage for HP Openview has been estimated from the determination of the frequency of transmission of the necessary information of all the appropriate attributes of the managed objects during one hour period. It was assumed that fourteen days worth of HP Openview data are stored.

A description of how application log file volume was estimated is in the previous section (Processing Requirements). Log file volume is provided in Tables 3.4.2.8.1-1 and 3.4.2.8.1-2, based on an assumption of fourteen days storage prior to archiving in the data server archive.

The storage requirement for the Management DBMS was based on a worst case assumption that all the records from both the log files and HP Openview are stored in the Management DBMS, with an additional 10% for table overhead and summarization records. It is assumed that one months worth of data are maintained in the Management DBMS at a time.

Storage requirements for Clearcase are based on the assumption that Clearcase will store, two copies of all source code (including ECS application source and algorithms) and two copies of all

executables. This will enable recovery of the previous version of any application if required. In addition, Clearcase will store test data and configuration files.

The subsystem performance monitoring frequency was considered for determining data storage sizing for Tivoli. Frequency of a typical fault notification and its size was not determined. Because a fault notification by design only occurs upon a triggered event (otherwise it is like a daemon), fault notification frequency is difficult to estimate.

Approximately 200 trouble tickets per day are estimated to be assigned, or 25 per hour. The size of a trouble ticket is approximately 256 characters. Trouble ticket frequency and size are worst case.

To determine DDTS sizing requirements, the frequency non-conformance reports (NCRs) are generated on a daily basis and was identified with the report size. A NCR was evaluated due to its similarity to a configuration change request (CCR). The number of CCRs estimated to occur is to be determined.

At Release A, the storage requirement for the Sybase DBMS is estimated to be 196 MB, Clearcase 2.9 GB, Tivoli 5MB, Remedy 3 MB, DDTS 2 MB, and 3.1 GB for all other COTS combined. The storage requirement for CSS includes those of directory, security, mail and DCE COTS. Storage requirements for DCE directory and security stores (1Kbyte per record and 200 bytes per record respectively) were derived from the number of Release A users in the technical baseline. The total storage requirements for CSS is estimated to be 1 MB for Release A.

At Release B, the storage requirement for the Sybase DBMS is estimated to be 5.4 GB, Clearcase 3.9 GB, Tivoli 5 MB, Remedy 3 MB, DDTS 2 MB, and 6.3 GB for all other COTS combined. For Clearcase, source and executable codes for PGE's and ECS are assumed to grow 4 times w/ respect to Release A . Other COTS such as Tivoli and DDTS are expected to grow by 100% from Release A. Storage requirements for DCE directory and security stores are based on the number of users expected to increase from 448 users to 16,000. The total storage requirements for CSS is estimated to be 468 MB for Release B.

The total storage requirement for Release A is estimated to be between 8 and 10 GB (assuming some additional storage for Sybase swap space). The total storage requirement for Release B is estimated to be between 18 and 20 GB.

***Table 3.4.2.8.1-7. MSFC MSS Release A Storage Requirements (1 of 2)***

| Datastore | Freq. of Events/Hr | Size in Bytes/ Transaction | Size in Bytes Transmitted/Hr | Storage Requirements (MB) |
|---|---|---|---|---|
| HP Openview Datastore | 39,768 | 5 | 198,840 | 67 |
| Application log files | 242 | 192* | 65,664 | 22 |
| Sybase DBMS | | | | 196 |
| Clearcase | | | | 2,907 |
| Tivoli | 60 | 256 | 15,360 | 5 |

### *Table 3.4.2.8.1-7. MSFC MSS Release A Storage Requirements (2 of 2)*

| Datastore | Freq. of Events/Hr | Size in Bytes/ Transaction | Size in Bytes Transmitted/Hr | Storage Requirements (MB) |
|---|---|---|---|---|
| Remedy | 25 | 256 | 6400 | 3 |
| DDTS | 2 | 2400 | 4800 | 2 |
| Other COTS and product executables | | | | 3,128 |
| Total Storage Requirement | | | | 6,320 |

* Application polling generates 512 byte logs. These have been included in the per hour total.

### *Table 3.4.2.8.1-8. MSFC MSS Release B Storage Requirements*

| Datastore | Freq. of Events/Hr | Size in Bytes/ Transaction | Size in Bytes Transmitted/Hr | Storage Requirements (MB) |
|---|---|---|---|---|
| HP Openview Datastore | 39, 768 | 5 | 198,840 | 67 |
| Application log files | 422 | 192* | 100,224 | 34 |
| Sybase DBMS | | | | 222 |
| Clearcase | | | | 3,942 |
| Tivoli | 60 | 256 | 15,360 | 5 |
| Remedy | 25 | 256 | 6400 | 3 |
| DDTS | 2 | 2400 | 4800 | 2 |
| Other COTS and product executables | | | | 6,256 |
| Total Storage Requirement | | | | 10, 531 |

***** Application polling generates 512 byte logs. These have been included in the per hour total.

### *Table 3.4.2.8.1-9. MSFC CSS Release A Storage Requirements*

| CSS Data Store | # of Users | Size of Record (# Bytes) | Storage Requirements (MB) |
|---|---|---|---|
| DCE Directory | 448 | 1,000 | 0.4 |
| DCE Security | 448 | 200 | 0.1 |
| Mail | 87 | 4,000 | 0.5 |
| Total Storage Requirement | | | 1 |

***Table 3.4.2.8.1-10. MSFC CSS Release B Storage Requirements***

| CSS Data Store | # of Users | Size of Record (# Bytes) | Storage Requirements (MB) |
|---|---|---|---|
| DCE Directory | 16,000 | 1,000 | 224 |
| DCE Security | 16,000 | 1,000 | 224 |
| Mail | 348 | 4,000 | 20 |
| Total Storage Requirement | | | 468 |

***Processor Selection*** Choice of the MSS/CSS Server platform was based on Release A and Release B processing requirements, COTS to be hosted on the platform, and price/performance data provided by EDS. Based on the Release B processing requirements, a medium-range server class platform (uniprocessor) was chosen. HP is the preferred vendor, since HP Openview and OODCE will be principal COTS products on these platforms, and HP is one of the principal developers of DCE and OODCE.

### 3.4.2.8.2 Configuration

The following configuration will be provided for the MSFC LSM for Release A, which includes the MSS MHWCI and the CSS DCHWCI.

- MSS Local Management Server and CSS Communications Server: 2 HP 9000 J210/1 processors, rated at 176 MIPS, 256 MB of RAM and 2 GB of storage.
- RAID Storage: 10 GB storage x 2 RAID partitions for 20 GB total
- Workstations:
  - 1 Sun Sparc 20/50 with 130 MIPS, 128 MB of RAM and 4 GB of storage (This workstation will house configuration management software)
  - 1 Sun Sparc 20/50 with 130 MIPS, 64 MB of RAM and 2 GB of storage
  - 1 HP Laser Jet 4M+ Printer, 12 ppm/14 MB.

The MSFC DAAC will contain two primary servers for its LSM configuration, cross-strapped to RAID disk to enable warm backup. MSS and CSS applications will run on separate processors but in case of contingency, either system will be capable of running both subsystems.

The HP 9000 J210/1 is a high performance processor specifically designed for compute intensive and graphic applications. It includes a 176 MIPS processor which supports our requirements of less than 130 MIPS for Release A and approximately 147 MIPs for Release B as shown in Table 3.4.2.8.1-5.

The configuration at MSFC will include two Sun Sparc 20/50 workstations. One of the workstations which will house configuration management software will be configured with higher memory and higher storage (128 MB of RAM and 4 GB of hard drive).

## 3.5 Software/Hardware Mapping

Table 3.5-1 provides a mapping of MSFC Release B software components to hardware. With the exception of the Client subsystem, each subsystem has been designed to incorporate hardware CIs that include the components (processors, servers, archive robotics, etc.) on which the software components run. While the Interoperability Subsystem includes a hardware CI, Advertising Server (SDSHW), the advertising capabilities will be supported on the Data Management HWCI. The Management and Communications subsystems include software components that execute on hardware within these subsystems, as well as on hardware across all the subsystems with hardware CIs. Table 3.5-1 provides a mapping of MSFC ECS Release B software components to the applicable hardware components. See note at bottom of table for mapping of HWCI units to the numbers identified in the table.

***Table 3.5-1 MSFC Software to Hardware Analysis (1 of 9)***

| Subsystem | CSCI | CSC | HWCI /units | NOTES |
|---|---|---|---|---|
| Client | DESKT | Desktop Manager | 5,7,9,12,22,23,26 | |
| Client | WKBCH | Hypertext Viewer | | Has no HWCI. Goes on operator's and/or science workstations. |
| Client | WKBCH | Earth Science Search Tool | | " |
| Client | WKBCH | Product Request Tool | | " |
| Client | WKBCH | Release A Client | | " |
| Client | WKBCH | Document Search Tool | | " |
| Client | WKBCH | Advertising Client Tool | | " |
| Client | WKBCH | User Registration Tool | | " |
| Client | WKBCH | User Preferences Tool | | " |
| Client | WKBCH | Data Acquisition Tool | | " |
| Client | WKBCH | E-mailer Tool | | " |
| Client | WKBCH | Logger/Reviewer Tool | | " |
| Client | WKBCH | Data Dictionary Tool | | " |
| Client | WKBCH | Comment/Survey Tool | | " |
| Client | WKBCH | Visualization Tool | | " |
| Client | WKBCH | News Reader Tool | | " |

***Table 3.5-1 MSFC Software to Hardware Analysis (2 of 9)***

| Subsystem | CSCI | CSC | HWCI /units | NOTES |
|---|---|---|---|---|
| Client | WKBCH | Hypertext Authoring Tool | | " |
| CSS | DCCI | Directory/Naming Services | 28 | |
| CSS | DCCI | DOF Services | 28 | |
| CSS | DCCI | Electronic Mail Services | 29 | |
| CSS | DCCI | Event Logger Services | 29 | |
| CSS | DCCI | File Access Services | 29 | |
| CSS | DCCI | Life Cycle Services | 29 | |
| CSS | DCCI | Message Passing Services | 29 | |
| CSS | DCCI | Security Services | 28 | |
| CSS | DCCI | Thread Services | 29 | |
| CSS | DCCI | Time Services | 29 | |
| CSS | DCCI | Virtual Terminal Services | 28 | |
| Data Management | DDICT | Data Dictionary Server | 24 | |
| Data Management | DDICT | Data Dictionary DBMS | 24 | |
| Data Management | DIMGR | Distributed Information Manager | 24 | |
| Data Management | GTWAY | Gateway DBMS | 24 | |
| Data Management | GTWAY | Gateway Server | 24 | |
| Data Management | GTWAY | GCMD Exporter<br>QO | 24 | |
| Data Management | LIMGR | LIM Server | 24 | |
| Data Management | LIMGR | LIM DBMS | 24 | |
| Data Management | DIMGR | DIM Server | 24 | |
| Data Management | DIMGR | DIM DBMS | 24 | |
| Data Processing | AITTL | Binary File Comparison Utility | 4, 1 | |
| Data Processing | AITTL | Code Analysis Tools | 4, 1 | |

***Table 3.5-1 MSFC Software to Hardware Analysis (3 of 9)***

| Subsystem | CSCI | CSC | HWCI /units | NOTES |
|---|---|---|---|---|
| Data Processing | AITTL | Data Visualization Tools | 4, 5 | |
| Data Processing | AITTL | Documentation Viewing Tools | 4, 5 | |
| Data Processing | AITTL | ECS HDF Visualization Tools | 4, 5 | |
| Data Processing | AITTL | HDF File Comparison Utility | 4, 1 | |
| Data Processing | AITTL | PGE Processing GUI | 5 | |
| Data Processing | AITTL | PGE Registration GUI | 5 | |
| Data Processing | AITTL | Product Metadata Display Tool | 5 | |
| Data Processing | AITTL | Profiling Tools | 4, 1 | |
| Data Processing | AITTL | Report Generation Tools | 4 | |
| Data Processing | AITTL | SDP Toolkit-related Tools | 5 | |
| Data Processing | AITTL | SSAP Processing GUI | 5 | |
| Data Processing | AITTL | Standards Checkers | 4, 1 | |
| Data Processing | AITTL | Update Data Server GUI | 5 | |
| Data Processing | PRONG | COTS | 4 or 5 | |
| Data Processing | PRONG | COTS Management | 4 or 5 | |
| Data Processing | PRONG | Data Management | 4 or 5 | |
| Data Processing | PRONG | Data Pre-Processing | 1 | |
| Data Processing | PRONG | PGE Execution Management | 2,8(backup), 1 | |
| Data Processing | PRONG | Quality Assurance Monitor Interface | 7 (if configured) | |
| Data Processing | PRONG | Resource Management | 2,8(backup), 1 | |

***Table 3.5-1 MSFC Software to Hardware Analysis (4 of 9)***

| Subsystem | CSCI | CSC | HWCI /units | NOTES |
|---|---|---|---|---|
| Data Processing | SDPTK | Ancillary Data Access | 1, 4 | |
| Data Processing | SDPTK | Celestial Body Position | 1, 4 | |
| Data Processing | SDPTK | Constant and Unit Conversions | 1, 4 | |
| Data Processing | SDPTK | Coordinate System Conversion | 1, 4 | |
| Data Processing | SDPTK | EOS-HDF | 1, 4 | |
| Data Processing | SDPTK | Spacecraft Ephemeris and Attitude Access | 1, 4 | |
| Data Processing | SDPTK | Geo Coordinate Transformation | 1, 4 | |
| Data Processing | SDPTK | Graphics Library | 1, 4 | |
| Data Processing | SDPTK | File Input/Output Tools | 1, 4 | |
| Data Processing | SDPTK | Math Package (IMSL) | 1, 4 | |
| Data Processing | SDPTK | Memory Management | 1, 4 | |
| Data Processing | SDPTK | Metadata Access | 1, 4 | |
| Data Processing | SDPTK | Process Control | 1, 4 | |
| Data Processing | SDPTK | Time Date Conversion | 1, 4 | |
| Data Server | DDIST | Distribution Client Interface | 14 | |
| Data Server | DDIST | Distribution Products | 14 | |
| Data Server | DDIST | Distribution Request Management | 14 | |
| Data Server | DDSRV | DDSRV | 20 | |
| Data Server | DDSRV | DDSRV Client | 20 | |
| Data Server | DDSRV | DDSRV CSDT | 20 | |
| Data Server | DDSRV | DDSRV ESDT | 20 | |
| Data Server | DDSRV | DDSRV Search Engine | 20 | |
| Data Server | DDSRV | DDSRV Server | 20 | |
| Data Server | SDSRV | Administration and Operations | 13 | |

***Table 3.5-1 MSFC Software to Hardware Analysis (5 of 9)***

| Subsystem | CSCI | CSC | HWCI /units | NOTES |
|---|---|---|---|---|
| Data Server | SDSRV | Client | 13 | |
| Data Server | SDSRV | Configuration and Startup | 13 | |
| Data Server | SDSRV | CSDT | 13 | |
| Data Server | SDSRV | DB Wrappers | 13 | |
| Data Server | SDSRV | Descriptors | 13 | |
| Data Server | SDSRV | General ESDT | 13 | |
| Data Server | SDSRV | Global | 13 | |
| Data Server | SDSRV | GUI | 13 | |
| Data Server | SDSRV | LIS | 13 | |
| Data Server | SDSRV | Metadata | 13 | |
| Data Server | SDSRV | Non-Product Science ESDT | 13 | |
| Data Server | SDSRV | Non-Science ESDT | 13 | |
| Data Server | SDSRV | New ESDTs | 13 | Combination of new CSCs |
| Data Server | SDSRV | PR | 13 | |
| Data Server | SDSRV | Server | 13 | |
| Data Server | SDSRV | Subscriptions | 13 | |
| Data Server | SDSRV | TMI | 13 | |
| Data Server | STMGT | Service Clients | 13,14,17 | |
| Data Server | STMGT | Data Storage | 17 | |
| Data Server | STMGT | File | 13,17 | |
| Data Server | STMGT | Peripherals | 13,14,17 | |
| Data Server | STMGT | Resource Management | 13,14,17 | |
| Ingest | INGST | Client Services | 10 | |
| Ingest | INGST | Data Storage | 10 | |
| Ingest | INGST | Ingest Administration Data | 11 | |
| Ingest | INGST | Ingest Data Preprocessing | 10 | |
| Ingest | INGST | Ingest Data Transfer | 10 | |
| Ingest | INGST | Ingest DBMS | 10 | |
| Ingest | INGST | Ingest Request Processing | 10 | |
| Ingest | INGST | Ingest Session Manager | 10 | |
| Ingest | INGST | Operator Ingest Interfaces | 11 | (X-term access) |

***Table 3.5-1 MSFC Software to Hardware Analysis (6 of 9)***

| Subsystem | CSCI | CSC | HWCI /units | NOTES |
|---|---|---|---|---|
| Ingest | INGST | Polling Ingest Client Interface | 10 | |
| Ingest | INGST | Resource Management | 11 | |
| Ingest | INGST | User Network Ingest Interface | 30 | |
| Ingest | INGST | Viewing Tools | 11 | |
| Ingest | INGST | Configuration/Startup | 11 | |
| Ingest | INGST | Metadata | 11 | |
| Ingest | INGST | CSDT | 11 | |
| Ingest | INGST | DB Wrappers | 11 | |
| Ingest | INGST | Descriptors | 11 | |
| Ingest | INGST | General ESDT | 11 | |
| Ingest | INGST | Global | 11 | |
| Ingest | INGST | GUI | 11 | |
| Ingest | INGST | LIS | 11 | |
| Ingest | INGST | Non-Product Science ESDTs | 11 | |
| Ingest | INGST | Non-Science ESDTs | 11 | |
| Ingest | INGST | Server | 11 | |
| Ingest | INGST | Subscriptions | 11 | |
| Ingest | INGST | Service Clients | 11 | |
| Ingest | INGST | File | 11 | |
| Ingest | INGST | Distribution Products | 11 | |
| Ingest | INGST | Distribution Client Interface | 11 | |
| Ingest | INGST | Distribution Request Management | 11 | |
| Interoperability | ADSRV | AdvDBMSApplServer | 24 | |
| Interoperability | ADSRV | AdvDBMSServer | 24 | |
| Interoperability | ADSRV | AdvTextServer | 24 | |
| Interoperability | ADSRV | AdvNavigatingServer | 24 | |
| ISS | INCI | Datalink/Physical | 26 or 27 | |
| MSS | MACI | Application MIB | 26 or 27 | |
| MSS | MACI | DCE Proxy Agent | 26 or 27 | |
| MSS | MACI | ECS Subagent | 26 or 27 | |
| MSS | MACI | Encapsulator for non-Peer Agent | 26 or 27 | |

***Table 3.5-1 MSFC Software to Hardware Analysis (7 of 9)***

| Subsystem | CSCI | CSC | HWCI /units | NOTES |
|---|---|---|---|---|
| MSS | MACI | Extensible SNMP Master Agent | 26 or 27 | |
| MSS | MACI | Instrumentation Class Library | 26 or 27 | |
| MSS | MACI | SNMP Manager's Deputy | 26 or 27 | |
| MSS | MCI | Accountability Manager | 27,28 | |
| MSS | MCI | Accountability Proxy Agent | 27 or 28 | |
| MSS | MCI | Application Management | 26 or 27 | |
| MSS | MCI | Automatic Actions | 26 or 27 | |
| MSS | MCI | BAAC Configuration (Billing And ACount.) | 26 or 27 | |
| MSS | MCI | BAAC Manager QO | 26 or 27 | |
| MSS | MCI | BAAC Proxy Agent | 26 or 27 | |
| MSS | MCI | DCE Cell Management | 26 or 27 | |
| MSS | MCI | Diagnostic Tests | 26 or 27 | |
| MSS | MCI | Management Data Access Services | 26 or 27 | |
| MSS | MCI | Management Data Access User Interface | 26 or 27 | |
| MSS | MCI | Management DBMS | 26 or 27 | |
| MSS | MCI | Management DBMS Proxy Agent | 26 or 27 | |
| MSS | MCI | Management Framework | 26 or 27 | |
| MSS | MCI | Management Proxy | 26 or 27 | |
| MSS | MCI | Mode Management | 26 or 27 | |
| MSS | MCI | Network Manager | 27, 28 | |
| MSS | MCI | Performance Management Proxy | 26 or 27 | |
| MSS | MCI | Performance Manager | 27,28 | |
| MSS | MCI | Performance Test | 26 or 27 | |
| MSS | MCI | Performance Trending | 26 or 27 | |
| MSS | MCI | Physical Configuration Manager | 27, 28 | |
| MSS | MCI | Physical Configuration Proxy Agent | 27, 28 | |

***Table 3.5-1 MSFC Software to Hardware Analysis (8 of 9)***

| Subsystem | CSCI | CSC | HWCI /units | NOTES |
|---|---|---|---|---|
| MSS | MCI | Report Generation and Distribution | 27,28 | |
| MSS | MCI | Report Generation Manager | 26 or 27 | |
| MSS | MCI | Report Generation Proxy Agent | 26 or 27 | |
| MSS | MCI | Report Generation User Interface | 26 or 27 | |
| MSS | MCI | Report Generator | 26 or 27 | |
| MSS | MCI | Resource Class Category | 26 or 27 | |
| MSS | MCI | Security Databases | 26 or 27 | |
| MSS | MCI | Security Management Proxy Agent | 26 or 27 | |
| MSS | MCI | Security Manager | 26 or 27 | |
| MSS | MCI | Security Tests | 26 or 27 | |
| MSS | MCI | Transaction Generator | 26 or 27 | |
| MSS | MCI | Trouble Ticketing Management Services | 27,28 | |
| MSS | MCI | Trouble Ticketing Proxy Agent | 27,28 | |
| MSS | MCI | Trouble Ticketing Service Requester | 26 or 27 | |
| MSS | MCI | Trouble Ticketing User Interface | 27,28 | |
| MSS | MCI | User Profile Server | 26 or 27 | |
| MSS | MLCI | Baseline Manager | 26 or 27 | |
| MSS | MLCI | Change Request Manager | 26 or 27 | |
| MSS | MLCI | Inventory Manager | 26 or 27 | |
| MSS | MLCI | License Manager | 26 or 27 | |
| MSS | MLCI | Logistics Manager | 26 or 27 | |
| MSS | MLCI | Maintenance Manager | 26 or 27 | |
| MSS | MLCI | Policies and Procedures Manager | 26 or 27 | |
| MSS | MLCI | Software Change Manager | 26 or 27 | |
| MSS | MLCI | Software Distribution Manager | 26 or 27 | |
| MSS | MLCI | Training Manager | 26 or 27 | |

***Table 3.5-1 MSFC Software to Hardware Analysis (9 of 9)***

| Subsystem | CSCI | CSC | HWCI /units | NOTES |
|---|---|---|---|---|
| Planning | PLANG | On Demand Manager | 2,8 | |
| Planning | PLANG | PDPS DBMS | 2,8 | |
| Planning | PLANG | Planning Object Library | 2,8 | |
| Planning | PLANG | Production Planning Workbench | 2,8 | |
| Planning | PLANG | Production Request Editor | 2,8 | |
| Planning | PLANG | Subscription Editor | 2,8 | |
| Planning | PLANG | Subscription Manager | 2,8 | |

Note: Unit mapping
1== SPRHW/science processors
2==SPRHW/queuing management server
4==AITHW/AI&T DBMS server
5==AITHW/AI&T Operations workstations
7==AQAHW/QA workstations
8==PLNHW/planning server
9==PLNHW/planning workstations
10==ICLHW/ingest server
11==ICLHW/ingest workstation
12==ACMHW/administration and operations workstations
13==ACMHW/APC servers
14==DIPHW/distribution servers
17==DRPHW/FSMS servers
18==DRPHW/archive robotics
19==DRPHW/DBMS servers
20==DRPHW/document server
22==DMGHW/data specialist workstations
23==DMGHW/administration and operations workstations
24==DMGHW/DBMS servers
26==MSS/MSS workstations
27==MSS/MSS Local System Management server
28==CSS/CSS server
29== all workstations and hosts
30== User workstation

# 4. Future Releases

This document has described the design of ECS subsystems for the MSFC ECS DAAC at Release B. Two other releases are currently planned. The next release, Release C, is scheduled for December 1999. The Release Plan Content Description for the ECS Project describes in detail the capabilities being provided in Releases C and D. In summary, Release C will provide evolutionary enhancements to Release B, Flight Operations for EOS PM1, and the CORBA and Trader designs. An updated version of this document will precede Release C and will reflect the design corresponding to that release.

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# Abbreviations and Acronyms

| | |
|---|---|
| ACMHW | Access Control and Management HWCI |
| ADC | Affiliated Data Center |
| ADS | Archive data sets |
| ADSHW | Advertising Service HWCI |
| ADSRV | Advertising Service CSCI |
| AHWGP | Ad Hoc Working Group on Production |
| AITHW | Algorithm Integration & Test HWCI |
| AITTL | Algorithm Integration and Test Tools (CSCI) |
| AM | Ante meridian |
| ANSI | American National Standards Institute |
| APC | Access/Process Coordinators |
| API | Application Programming Interface |
| APID | Application Process Identifier |
| AQAHW | Algorithm QA HWCI |
| ASAP | As soon as possible |
| ASCII | American Standard Code for Information Interchange |
| ASF | Alaska SAR Facility (DAAC) |
| ATM | Asynchronous Transfer Mode |
| CD ROM | Compact disk read only memory |
| CDRL | Contract Data Requirements List |
| CERES | Clouds and Earth's Radiant Energy System |
| CI | Configuration Item |
| CIESIN | Consortium for International Earth Science Information Network |
| CLS | Client Subsystem |
| COTS | Commercial off-the-shelf |
| CPU | Central processing unit |
| CSC | Computer Software Component |
| CSCI | Computer Software Configuration Item |

| | |
|---|---|
| CCSDS | Consultative Committee for Space Data Systems |
| CM | Configuration Management |
| CSDT | Computer Science Data Types |
| CSMS | Communications and Systems Management Segment |
| CSS | Communication Subsystem (CSMS) |
| DAA | DAN Acknowledge |
| DAAC | Distributed Active Archive Center |
| DADS | Data Archive and Distribution System |
| DAN | Data Availability Notice |
| DAO | Data Assimilation Office |
| DAR | Data Acquisition Request |
| DAS | Data Availability Schedule |
| DBA | Database administrator |
| DBMS | Database Management System |
| DDA | Data Delivery Acknowledgement |
| DDTS | Distributed Defect Tracking System |
| DDICT | Data Dictionary CSCI |
| DDIST | Data Distribution CSCI |
| DDN | Data Delivery Notice |
| DDSRV | Document Data Server CSCI |
| DESKT | Desktop CI |
| DEV | Developed code |
| DID | Data Item Description |
| DIM | Distributed Information Manager |
| DIMGR | Distributed Information Management CSCI |
| DIPHW | Distribution & Ingest Peripheral Management HWCI |
| DMGHW | Data Management HWCI |
| DMS | Data Management System |
| DMS | Data Management Subsystem |
| DP | Data Processing |
| DPR | December Progress Review |

| | |
|---|---|
| DPREP | Science Data Pre-Processing CSCI |
| DPS | Data Processing Subsystem |
| DR | Data Repository |
| DRPHW | Data Repository HWCI |
| DS | Data Server |
| DSM | Distribution Storage Management |
| DSS | Data Server Subsystem |
| DT | Data Type |
| ECS | EOSDIS Core System |
| EDC | EROS Data Center (DAAC) |
| EDOS | EOS Data and Operations System |
| EOS | Earth Observing System |
| EOSDIS | Earth Observing System Data and Information System |
| EP | Evaluation Package |
| EP | Early Prototype |
| ESDIS | Earth Science Data and Information System |
| ESDT | Earth Science Data Types |
| F&PRS | Functional and Performance Requirements Specification |
| FC | Fiber Channel |
| FDDI | Fiber distributed data interface |
| FDF | Flight Dynamics Facility |
| FOS | Flight Operations Segment |
| FSMS | File and Storage Management System |
| Ftp | File transfer protocol |
| GB | Gigabyte |
| GDAO | GSFC Data Assimilation Office |
| GFLOPS | Giga (billions) Floating Point Operations per Second |
| GOES | Geostationary Operational Environmental Satellite |
| GRIB | Gridded Binary |
| GSFC | Goddard Space Flight Center |
| GTWAY | Version 0 Interoperability Gateway CSCI |

| | |
|---|---|
| GUI | Graphic user interface |
| HDF | Hierarchical Data Format |
| HiPPI | High Performance Parallel Interface |
| HMI | Human machine interface |
| HTML | Hypertext Markup Language |
| HWCI | Hardware Configuration Item |
| I&T | Integration and Test |
| I/O | Input/Output |
| IAS | Image Assessment System |
| ICD | Interface Control Document |
| ICLHW | Ingest Client HWCI |
| IDL | Interface Definition Language |
| IEEE | Institute of Electrical and Electronics Engineers |
| IERS | International Earth Rotation Service |
| IGS | International Ground Station |
| IP | International Partner |
| IR-1 | Interim Release 1 |
| IRD | Interface Requirements Document |
| IS | Ingest Subsystem |
| JPL | Jet Propulsion Laboratories |
| LaRC | Langley Research Center |
| LIM | Local Information Manager |
| LIMGR | Local Information Management CSCI |
| LIS | Lightning Imaging Sensor |
| L0 | Level 0 |
| MB | Megabyte |
| Mbps | Megabits per second |
| MBps | Megabytes per second |
| MD | Maryland |
| MFLOP | Millions of Floating Point Operations per Second |
| MOC | Mission Operations Center |

| | |
|---|---|
| MODIS | Moderate-Resolution Imaging Spectrometer |
| MPP | Massively Parallel Processor |
| MRF | Medium Range Forecast |
| MSFC | Marshall Space Flight Center |
| MSS | Management Subsystem (CSMS) |
| MTBF | Mean time between failures |
| MTTR | Mean time to restore |
| NESDIS | National Environmental Satellite Data and Information Service |
| NMC | National Meteorological Center |
| NOAA | National Oceanic and Atmospheric Administration |
| NSIDC | National Snow and Ice Data Center (DAAC) |
| O/A | Orbit/Attitude |
| ODC | Other Data Center |
| ODL | Object Description Language |
| ORNL | Oak Ridge National Laboratory (DAAC) |
| OSM | Open Storage Manager |
| OTS | Off-the-shelf |
| PAM | Permanent Archive Manager |
| PCI | Peripheral Component Interface |
| PDPS | Planning and Data Processing System |
| PDR | Preliminary Design Review |
| PDS | Production Data Set |
| PDS | Production Data Specialist |
| PGE | Product Generation Executive |
| PGS | Product Generation System |
| PLNHW | Planning HWCI |
| POSIX | Portable Operating System for UNIX |
| PRONG | Processing CSCI |
| Q | Quarter |
| Q/A | Quality Assurance |
| QA | Quality Assurance |

| | |
|---|---|
| QAC | Quality and Accounting Capsule |
| RAID | Redundant Array of Inexpensive Disks |
| RAM | Random Access Memory |
| REL | Release |
| RID | Review Item Discrepancy |
| RMA | Reliability, Maintainability, Availability |
| RTF | Rich Text Format |
| S/C | Spacecraft |
| SAA | Satellite Active Archives (NOAA) |
| SCF | Science Computing Facility |
| SCSI II | Small Computer System Interface |
| SDF | Software Development File |
| SDP | Science Data Processing |
| SDPF | Sensor Data Processing Facility (GSFC) |
| SDPS | Science Data Processing Segment |
| SDPS/W | Science Data Processing Software |
| SDPTK | SDP Toolkit CSCI |
| SDSRV | Science Data Server CSCI |
| SFDU | Standard Format Data Unit |
| SMC | System Management Center |
| SMP | Symmetric Multi-Processor |
| SPRHW | Science Processing HWCI |
| STMGT | Storage Management CSCI |
| TBD | To be determined |
| TBR | To be resolved |
| TDRSS | Tracking and Data Relay Satellite System |
| TONS | TDRSS Onboard Navigation System |
| TRMM | Tropical Rainfall Measuring Mission |
| TSDIS | TRMM Science Data and Information System |
| UR | Universal Reference |
| USNO | United States Naval Observatory |

| | |
|---|---|
| V0 | Version 0 |
| VC | Virtual Channel |
| VCDU-ID | Virtual Channel ID |
| WAIS | Wide Area Information Servers |
| WAN | Wide Area Network |
| WKBCH | Workbench CI |
| WKSHC | Working Storage HWCI |
| W/S | Workstation |
| WORM | Write Once Read Many |
| WS | Working Storage |
| WWW | World Wide Web |

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